ENERGY ENGINEERING ANALYSIS

19971017 114

VOLUME 1A EXECUTIVE SUMMARY

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
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23 July 1982

U.S. Department of the Army
District Corps of Engineers
6014 U.S. Post Office and Courthouse
Omaha, Nebraska

Attn: Mr. Charles Pribyl

Re: DACA 45-80-C-0143
File: 15195(1)

Forwarded for your review and comment is the final submittal for the Fort Benjamin Harrison Energy Engineering Analysis for the above referenced contract.

Very truly yours,

EDM, INCORPORATED

James L. Clowers /nes

James L. Clowers, P.E.
Vice President

JLC:ge

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VOLUME 1A EXECUTIVE SUMMARY

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VOLUME 1A - EXECUTIVE SUMMARY

1.0 GENERAL DISCUSSION

1.0 General Discussion

Although Fort Benjamin Harrison has substantially reduced basewide energy consumption during the past six years, and with the recommended energy plan (see Section 2) proposed by this study should exceed TRADOC goals for FY85, some additional comments and recommendations are included in the following paragraphs to assist installation personnel in future planning.

1.1 Space Utilization: This is a very sensitive subject which we hesitate to bring up because it inevitably triggers controversy. However, we feel a few observations and suggestions are appropriate at this time.

The Finance Center was constructed to house a much larger work force due to a larger Army, a manual accounting system, and a hard copy filing system. Through computerization of the accounting system, this work force has been drastically reduced, and through microfische technique the file storage space requirements have been reduced substantially. Consequently, there are large areas which are not utilized at all, and other areas where the distance between people and furniture is excessive. In some cases, one person with a desk may occupy an entire 24' x 24' bay area. This requires the entire space in the Finance Center be conditioned and does not appear to be an efficient use of energy.

We predict that if the space requirements of all the functions in the Finance Center were evaluated against Army standards, and they were compressed into that space, one entire floor would become vacant. While that space could be closed off and heating temperatures reduced to just above freezing, this alternative is not a desirable use of the space. The building is serviced by a central plant, which already has excess capacity, and is using the least expensive energy available. Therefore, the use of Building 1 should be maximized.

Previously, this excess space has been recommended for excess space conversion to classrooms to meet shortages in school facilities. This idea has been discarded because classrooms require building partitions, and these partitions would result in air flow problems. In addition, Building 1 is geographically removed from the main school area which could cause problems with coordination and control. If the remote location is not a problem, then the HVAC system can be altered to correct air flow.

There are many functions scattered over Fort Benjamin Harrison which could operate out of Building 1 just as effectively. For example, the headquarters function, including the Command Section and most of the staff functions in Buildings 600 and 601, as well as Legal, I.G., etc. in other buildings could all be grouped together on one floor within Building 1 and their current locations converted to either classrooms or other academic administrative functions

Recognizing the difficulty in assembling an unbiased study group at Fort Benjamin Harrison, it is recommended that an outside party study space utilization. Perhaps one of the Army Intermediate or Senior Services School would take the project on as a staff study or thesis topic. Otherwise, a consultant group should be hired.

1.2 Building 40, Bowling Center: Personnel entering the snack bar area of the bowling center must do so through the front door, which has a vestibule to minimize energy losses. However, when personnel leave the snack bar, most of them do so through the emergency fire exit on the west side, which saves a few steps to the parking lot. In the winter, this causes the building to be flooded with cold air every few minutes by the prevailing north wind. In the summer, valuable conditioned air is lost and replaced with the hot, humid air. Since humidity control is so vital in bowling alleys to prevent line damage, this practice causes an extra load.

It is recommended that the west entrance be labeled for emergency use only, and its use restricted to that. If this is undesireable, or impractical due to enforcement, a vestibule should be constructed to help reduce energy losses.

1.3 Barracks 420 and 421: The following paragraphs were transmitted to the Fort Benjamin Harrison Director of Engineering and Housing in letter dated 15 December 1981:

> The existing heating system in Buildings 420 and 421 is hot water finned tube radiation, piped in a reverse return circuit. This provides equal piping distance to each unit and should put all units in flow balance. Balancing valves are also provided at the return end of all elements and a manual radiator valve is provided at the supply end. If the balancing valve at each element is adjusted for proper flow the system will provide even heating throughout the building.
>
> However, the flow rates are very small and the velocity very low resulting in an almost impossible balancing task. All runouts are 3/4" in size with a required flow of .3 GPM to 2 GPM. The 3/4" pipe runouts have a flow capacity of up to 5 GPM if not balanced properly. Any out of balance first floor units will allow greater flow than required thus reducing the flow in the longer piping branches serving the third floor which has the greater flow requirement.

It was indicated by the Company Commander in Building 421 that the third floor is always cold and the first floor is always too hot. He and the Chief Clerk indicated that they were instructed by DFAE never to close the manual radiator valves because it would cause balance and heating problems in other areas of the building. However, the opposite is true. Any closed or partially closed valve in the overheated areas will allow more water to reach the colder areas and improve the heating output in this latter area.

The immediate short term solution is to instruct the occupants to use the manual radiator valve to reduce the overheating and thus correct the overall problem. Individuals are presently freezing on the third floor and occupants on the first floor are opening windows to keep from overheating.

The other apparent heating problem and energy waster is the summer ventilation system consisting of eight large centrifugal exhaust fans with 48" x 48" gravity backdraft dampers. These are loose and fail to stop a large cold draft from entering the building in the winter months. The cold

air spills into the rooms through the grilles installed for exhausting the space during the summer.

Rather than close off more than 100 exhaust grilles, the eight roof-mounted exhaust fans should be winterized. The short term solution is to close off the openings in the fan above the roof or close off the opening above the ceiling of the third floor with a removable insulating panel.

We recommend the short term solutions because of the programmed replacement of the heating system with a new combination heating/cooling system.

1.4 Interior Insulation of Masonry Walls: We were requested to investigate the feasbility of insulating existing masonry walls. We first looked at a theoretical wall with windows and no perimeter heating as the most simple, least expensive application. The treatment is 1" of styrofoam insulation applied directly to the masonry with 1" steel furring strips covered with 1/2" drywall which is taped, floated and painted. The estimated cost is $3.06/sq. ft. installed. This treatment lowers the U value from 0.29 to 0.126; Delta U = 0.164. Estimated savings per square foot for buildings on central plant steam are as follows:

$$\text{Savings} = \frac{1 \text{ SF} \times 0.164 \times 5577 \text{ degree days} \times 24 \text{ hours}}{0.604 \times 16^6} \times 0.71 =$$

$$= .0252 \text{ MBTU/year/SF}$$

$$0.0252 \times \$3.80 \text{ MBTU} = \$0.096/\text{year}$$

$$\text{Total Benefit} = 0.096 \times 14.777 = \$1.42$$

$$B/C = 1.42/3.06 = 0.46 \text{ (not acceptable)}$$

We did not continue to evaluate other masonry walls, because adding the complication of a perimeter heating/cooling system which would require additional costs (i.e. removal, reinstallation) would only reduce the E/C and B/C ratios. The only reason the exterior applications to Building 1 and 400 meet the criteria is because of the concurrent reduction of large window areas. This exterior treatment is related to the window removal because of the need to present a uniform finished surface.

1.5 Electronic Ignition and Automatic Stack Dampers on Furnace Boilers: The economic feasibility of furnace and boiler retrofit to these energy saving features is closely related to the age of the equipment. The limitation of this study to typical buildings did not permit a complete evaluation. The following analysis and guidelines are presented for the Facility Engineer's use in evaluating equipment for retrofit. The age guidelines are based upon the general economic life of 15 years and should be replaced with first hand knowledge of actual conditions.

1.5.1 Electronic Ignition on Natural Gas Furnaces and Boilers:

The average standing pilot in a residential gas furnace burns 1 - 2 cubic feet of gas per hour. For this analysis, 1.5 CFH will be used.

1.5 CFH x 24 hr/day x 365 days/yr = 13,140 CF/yr.

13,400 x 1.031 MBTU/1000 CF = 13.5 MBTU

13.5 MBTU x 2.84 = $38.50/year

Estimated cost of electric ignition conversion installed is $150.

CWE = 150 x $(1.05)^2$ = $165
Design = 150 x 1.06 = $175

$38.50/yr x 13.112 = $505

B/C = 505/175 = 2.9

E/C = 13.5/165 = 81.2

Payback = $165/$38.50 = 4.3

If the economic life of a furnace or boiler is 15 years, the installation of electronic ignition on any furnace 10 years old or older cannot be justified. However, anything installed in the last 10 years should be converted; all new purchased equipment should contain this feature.

1.5.2 Automatic Stack Dampers On Furnaces and Boilers:

Manufacturers project 12% savings for automatic stack dampers. For this analysis 10% will be used.

A typical furnace or boiler will be assumed to be 150,000 BTUH. Assuming that it is properly sized, the estimated annual consumption becomes:

$$\frac{0.150 \times 5577 \times 24}{66 \times 0.8 \text{ eff}} \times 0.71 \times 1.56 = 421 \text{ MBTU/year}$$

421 x 10% = 42.1 MBTU saved

Estimated cost of automatic stack dampers installed is $150.

For ECIP Economic Analysis:

CWE = $150 x $(1.05)^2$ = $165
Design = $165 x 1.06 = $175

42.1 x $2.84 = $119.50/year
$119.50 x 13.112 = $1568 benefit

B/C = 1568/175 = 8.96

E/C = 42.1/0.165 = 255

Payback = $165/$119.50 = 1.4 years

Any furnace or boiler with electronic ignition which does not presently have an automatic stack damper should have one installed. Any new installation should be purchased with both features.

1.6 Biomass: Evaluation of existing biomass forms revealed that none can compete with the present coal operation. However, should a costly modification to the central plant become necessary to meet some new EPA criteria, the biomass options should be evaluated again. There is a study under way (funded by a State of Indiana grant) which is evaluating a new form of densified biomass to compete with coal. This study should be closely followed and the results evaluated against the information furnished in Volume 1, Section 9.

1.7 Maintenance: The standard of maintenance at Fort Benjamin Harrison is relatively good in those areas affecting energy conservation. Some deterioration of weatherstripping and insulation, and a few water and steam leaks were observed, but these were relatively minor in nature. This observation is important because no amount of ECIP work will actually result in energy savings if it is allowed to deteriorate, or if the energy is lost down the drain or into the atmosphere before the ECO has the opportunity to save it.

For example, the energy lost in a gallon per minute leak is as follows:

Hot Water:

Some of the leaks are 140°F domestic hot water and others are 180°F heating system water, so 160°F will be used. Cold water temperature will be assumed to be 60°F.

Boiler efficiency, assume 0.75.

$$\frac{1 \text{ gpm } (8.34 \text{ lb/gal}) \ (160-60)^{\circ}\text{F} \ (1 \text{ BTU/lb}/^{\circ}\text{F})}{.75}$$

= 1112 BTU/min.
= 66720 BTUH
= 584.5 MBTU per year

Steam:

1 GPM water per minute as steam
Steam at 212°F, atmospheric pressure = 1150 BTU/lb

1150.4 BTU/lb (8.34 lb/gal) (1 gal/min) =

= 9594.3 BTU/min
= 575,658 BTUH
= 13.8 MBTU/day
= 5037 MBTU per year

An observation which can be made concerning maintenance personnel world-wide is that most do not really understand energy conservation and the relative importance of each element of the building system. They do not understand concepts such as infiltration and its effect on energy. We find the personnel at Fort Benjamin Harrison to be no exception to this general statement. Therefore, we recommend a short energy conservation awareness training session for maintenance personnel at the working level.

Use a simple heating and cooling load calculation to show the difference in percent of energy used for properly functioning building systems and those which have deteriorated. Show what hot or chilled water or steam leaks cost in terms of total building energy consumption. Show why doors and windows should fit tightly, why worn out weatherstripping should be replaced, and cracks and holes caulked. We think personnel who are aware of the significance of the problem are more apt to correct it when they see it.

2.0 ENERGY PLAN

2.0 Energy Plan

The following section enumerates feasible energy measures which have been accomplished to date and those proposed as future ECIP and Increment G projects.

The ECIPS which have been accomplished to date consist primarily of architectural modifications to buildings and family housing quarters. For example, insulation, window replacement, and installation of storm windows have been accomplished in several of FBH's facilities. As a result of energy conservation measures which have been undertaken since FY75, Fort Benjamin Harrison has experienced a substantial reduction in energy consumption. However, through the proposed ECIP and Increment G project, this installation should experience a further reduction in energy consumption and exceed Tradoc goals for FY85 (see Section 3 future projections). Section 2.1 lists the energy projects accomplished to date by installation and Section 2.2 summarizes proposed ECIP and Increment G projects. Section 2.2.1 provides 1391, 1391c, and an Economic Analysis Summary for each ECIP proposed, and section 2.2.2 presents feasible Increment G projects. The following paragraphs briefly describe these proposed ECIP and Increment G projects.

ECIPS

A. Installation of a medium-sized Energy Monitoring and Control System (EMCS) and RF are proposed for FBH. The buildings and systems recommended for EMCS and RF interface are currently operating on independent control systems which do not have the capability to optimize start/stop operation, accurately setback temperature, or initiate continuous adjustments to systems which are required to satisfy the given conditions and concurrently reduce energy consumption. This ECIP package recommends an integrated system to accomplish existing control deficiencies.

B. Although several previous ECIPS have proposed window modifications, an additional ECIP package is recommended for 58 buildings, along with ceiling insulation. This project recommends installation of thermopane glazing and storm windows in existing newer windows, and complete window replacement in badly deteriorated windows. Ceiling insulation (R-value of 30) is proposed for those buildings with little or no insulation.

C. Due to gross floor area (approximately 1,600,000 sq. ft.) in Building 1 this facility represents a major source of Fort Benjamin Harrison's energy requirements. Therefore, modifications to Building 1 are essential for significant reductions in basewide energy consumption. Through architectural and mechanical modifications, 122,674 MBTU savings per year are predicted for this building. The recommended alterations include a reduction in window area, new insulated window units, exterior wall insulation, conversion to variable air volume (VAV) systems and/or economizer capabilities, new controls, and reduction in outside air.

D. The military family housing units in Harrison Village have high energy requirements due to minimum or no insulation, lack of weatherstripping, deteriorated siding, and loose-fitting windows. As a result, an ECIP package is recommended to correct these problems and, in turn, reduce

energy consumption.

E. In addition to Building 1, Building 400, Gates-Lord Hall, represents a large facility with excessive window areas and no wall insulation. Architectural modifications consisting of a reduction in glass area, new insulated and tinted window units, and exterior wall insulation are proposed for this facility.

Increment G

A. Flow restrictors for all bachelor housing quarters containing showers are recommended to reduce domestic hot water energy requirements.

B. The existing constant volume mechanical system in Hawley Clinic requires reheat when the space's cooling load is less than that of the supply air. Since this facility was designed to accommodate a fully operational hospital, and is currently operated as an outpatient clinic with an emergency staff, the cooling load is substantially less than the design load. The proposed ECIP package consists of conversion from reheat zones to variable air volume (VAV) zones, installation of an enthalpy control economizer system (ECES), and a separate emergency area to allow independent operation from the large clinic fan system.

C. Building 2, the Central Plant, requires a blowdown heat recovery system on its boilers to prevent waste heat from being rejected into the sewer system. This recommended system reclaims waste heat, thereby reducing basewide energy consumption.

D. In addition to bachelor housing quarters, flow restrictors are also recommended for military family housing units to reduce domestic hot water usage.

E. A separate Increment G project is proposed for programmable thermostats in all military family housing units. These thermostats provide night setback capabilities, and temperatures can be programmed by DFAE personnel.

F. The hot water heaters in most military family housing units contain only a minimal insulation. Therefore, it is recommended that 349 hot water heaters receive 1-1/2" of fiberglass blanket insulation, and one heater (in Building 900) receive 2" of rigid insulation.

G. Several furnaces require replacement, and the proposed replacement units are gas furnaces which are properly sized to the building's heating load. The existing furnaces utilize #2 oil, and this fuel costs $9.88/MBTU, as comapred to $2.84/MBTU for natural gas.

H. Two separate projects, one for boilers and the other for a furnace replacement, are recommended for seven military family housing quarters. As described in the preceding Increment G project, these recommended boilers and furnace are gas-fired and properly sized for the building's heating load.

I. An analysis of Buildings 54, 433, 602, 609, and eight family housing units indicates that energy consumption and costs can be reduced by disconnecting their oil-fired boilers and adding these buildings to the central plant steam system. This recommendation is presented as two separate Increment G projects.

J. Although boiler replacement cannot be justified for several family housing units, conversion to gas burners provides substantially reduced energy costs. Gas burners are proposed for fourteen two-family housing units.

2.1 ECIPS ACCOMPLISHED TO DATE BY THE INSTALLATION

PROJECT NUMBER	MBTU SAVINGS
882.010 FY77 Insulation - FH	2,000
997.500 FY77 Insulation & Elect. Alt.	3,158
104.200 FY79 Replace Windows	96,000
111.000 FY80 Insulation & Storm Windows	
Subtotal	101,158 MBTU

OTHER ENERGY RELATED PROJECTS

FY81 DMAR & BMAR	17,731 MBTU's
Total	118,889 MBTU's

ECIPS savings were taken from "FBH Facilities Energy Plan" (March 81). Calculations for DMAR and BMAR savings were estimated and these calculations appear with the reference data for this study [Volume 3, Appendix 2 (Reference Data - Part 3)].

2.2 ECIP & INCREMENT G SUMMARY

ECIPS	E/C	B/C	Investment K$
EMCS - FY85	42	1.1	3102
Window Treatment - Insulation - FY85	30	2.6	666
Building 1 Improvements - FY84	30	1.8	4117
Alter Harrison Village - FY85	20	1.7	1290
Building 400 Improvements - FY85	15	1.1	1259
Subtotal			10434

Increment G - Estimates Based on FY82 $	E/C	B/C	Investment K$
Flow Restrictors (Bachelor Housing)	171	8.6	23
Alter Clinic HVAC	168	5.5	93
Blowdown Heat Recovery - Building 2	160	6.2	26.5
Flow Restrictors (MFH)	158	7.6	10.5
Programmable Thermostats (MFH)	151	8.7	59
Add HWH Insulation	121	4.3	10
Replace 37 Oil Furnaces with Gas	24	9.4	203
Replace/Convert Oil Boilers (MFH)	24	7.8	40.5
Convert 4 Buildings from #2 Oil to CP	22	8.5	74
Replace Oil Furnace (MFH)	16	6.4	4.7
Convert Oil Boilers to CP Steam (MFH)	15	3.6	119
Convert Oil Boilers to Natural Gas	--	12.1	74
Subtotal			737.2
Total			11171.2

2.2.1 ECIP RECOMMENDATIONS

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		20July82

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Energy Monitoring and Control System (EMCS)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
		T 403000	3102

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Install Central System	LS			1057
EMCS Hardware	LS			740
Install Building Systems	LS			988
RF Building Total	LS			16
Mechanical Modifications	LS			13
Subtotal				2813
Contingency (5%)				141
Total Contract Cost				2954
Supervision, Inspection & Overhead (5%)				148
Total Requested				3102

10. DESCRIPTION OF PROPOSED CONSTRUCTION : Install a complete Energy Monitoring and Control System (EMCS) to include the central system and facility to house it, field interface devices, building system sensors and controllers, radio frequency (RF) interface and controls and modifications to building controls needed to make the system effective. See 1391c for a definitive list of buildings involved and system proposed.

B/C: 1.1; E/C: 42; Payback: 13.9 years; Savings: 130,421 MBTU, $223,525/year.

11. REQUIREMENT: This project is required in order to help meet the Army's stated goals for energy use reduction in existing facilities. This project is submitted under the Energy Conservation Investment Program.

CURRENT SITUATION: The buildings and systems proposed for EMCS and RF interface presently are operating on independent control systems which do not have the capability to optimize start/stop operations, accurately set-back temperature, or make the continuous adjustments necessary to reduce energy consumption to the minimum required to satisfy given conditions. The Post does not currently have a central computer system capable of providing that capability.

IMPACT IF NOT PROVIDED: If this project is not completed, energy conservation will continue at its present rate as costs rise and the supply diminishes.

1. COMPONENT	FY 19_85 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		20July82

3. INSTALLATION AND LOCATION

Fort Benjamin Harrison, Indiana

4. PROJECT TITLE	5. PROJECT NUMBER
Energy Monitoring and Control System (EMCS)	T403000

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

DANIEL W. FRENCH
MG, USA
Commanding

Estimated Construction Start:	April 1985	Index: 3117
Estimated Midpoint of Construction:	October 1985	Index: 3324
Estimated Construction Completion:	April 1986	Index: 3357

DD FORM 1 DEC 76 1391c

MAY BE USED INTERNALLY EXHAUSTED

FOR OFFICIAL USE ONLY (WHEN DATA IS ENTERED)

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		20July82

3. INSTALLATION AND LOCATION

Fort Benjamin Harrison, Indiana

4. PROJECT TITLE	5. PROJECT NUMBER
Energy Monitoring and Control System (EMCS)	T403000

Buildings Involved

EMCS

1	35	127	436	614
2	36	300	460	618
13	38	400	466	663
17	40	410	470	664
18	46	422	479	665
20	54	424	500	669
28	55	428	529	700
31	100	433	609	705
32	101	434	610	
33	126	435	611	

RF Interface

26	206	228	474	622
29	207	229	475	707
39	212	237	481	708
43	213	332	501	710
108	218	427	602	711
109	219	441	604	800
116	222	452	616	803
204	223	473	619	805

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON POST FY 1985
PROJECT: ENERGY MONITORING AND CONTROL SYSTEM
ECON. LIFE: 15 YRS. DATE: 1/15/82 PREPARED BY: NEB

COST	
1. Non-recurring Initial Capital Costs:	
a. Current Working Estimate	$ 3,102,000.
b. Design	$ 177,000.
c. Salvage	$ 0.
d. Total	$ 3,279,000.
BENEFITS	
*2. Recurring Benefit/Cost Differential Other Than Energy:	
a. Annual Labor Decrease (+)/Increase (-)	$ -248,000./YR
b. Annual Material Decrease (+)/Increase (-)	$ 0./YR
c. Other Annual Decrease (+)/Increase (-)	$ 0./YR
d. Total Costs	$ -248,000./YR
e. 10% Discount Factor	7.980
f. Discounted Recurring Cost (d x e)	$-1,979,040.
3. Recurring Energy Benefit/Costs:	
a. Type of Fuel: ELECTRICITY	
(1) Annual Energy Decrease (+)/Increase (-)	73,461.MBTU
(2) Cost per MBTU	$ 1.83/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 139,924./YR
(4) Differential Escalation Rate (7%) Factor	12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ 1,717,987.
b. Type of Fuel: ELECTRICAL DEMAND	
(1) Annual Energy Decrease (+)/Increase (-)	0.MBTU
(2) Cost per MBTU	0.00/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 13,940./YR
(4) Differential Escalation Rate (7%) Factor	12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ 171,155.
c. Type of Fuel: COAL	
(1) Annual Energy Decrease (+)/Increase (-)	42,296.MBTU
(2) Cost per MBTU	$ 5.06/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 214,018./YR
(4) Differential Escalation Rate (5%) Factor	10.798
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ 2,310,966.
d. Type of Fuel: NATURAL GAS	
(1) Annual Energy Decrease (+)/Increase (-)	6,430.MBTU
(2) Cost per MBTU	$ 4.21/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 27,070./YR
(4) Differential Escalation Rate (8%) Factor	13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ 354,946.

e. Type of Fuel: #2 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		5,234.MBTU
(2) Cost per MBTU	$	14.63/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	76,573./YR
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	1,004,025.
f. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	5,559,079.
4. Total Benefits (Sum 2f + 3e)	$	3,580,039.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		1.1
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		130,421.
7. E/C Ratio (Line 6/Line 1a/1000)		42.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	223,525.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		13.9

*IAW HNDSP80-013-EDME the annual operation and maintenance is to be estimated at 10% of the original system cost unless other data is available. Location of the MCR in the central plant where there is a cross manning capability from an existing 24 hour operation will significantly reduce manpower requirements. We expect that reduction to be in the neighborhood of 20 - 25 percent. Therefore, O&M costs are estimated at 8% of the original system cost.

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		5 Jan 82

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Window Treatment, Insulation (ECIP)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	Various	402000	666

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Install Storm Windows	SF	45,817	4.75	218
Add Thermopane	SF	10,395	14.27	148
Install New Windows	SF	7,906	17.44	139
Install Ceiling Insulation	SF	140,450	0.69	97
Sub Total				604
Contingency (5%)				30
Total Contract Cost				634
Supervision, Inspection and Overhead (5%)				32
TOTAL REQUEST				666

10. DESCRIPTION OF PROPOSED CONSTRUCTION: Project involves energy conservation measures on 58 buildings (see 1391C for comprehensive list and detailed treatment). Work consists of window treatments ranging from storm windows on those buildings where window condition allows and adding thermopane glazing to existing windows in newer buildings with single glazing at present, to complete replacement of windows and frames in those too badly deteriorated. Several buildings have been identified with little or no ceiling insulation, and this project provides insulation to R-30.

B/C Ratio: 2.6; E/C Ratio: 30; Payback: 6.1 years; Savings: 19,761 MBTU, $108,647/year.

11. REQUIREMENT: This project is required to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: The buildings listed have been surveyed to identify deficiencies which result in excessive energy consumption. Many have been found with single pane glass in older loose fitting windows and with little or no insulation in the ceilings.

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		5 Jan 82

3. INSTALLATION AND LOCATION

Fort Benjamin Harrison, Indiana

4. PROJECT TITLE	5. PROJECT NUMBER
Window Treatment, Insulation (ECIP)	402000

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

DANIEL W. FRENCH
MG, USA
Commanding

Estimated Construction Start:	April 1985	Index:	3117
Estimated Midpoint of Construction:	July 1985	Index:	3183
Estimated Construction Completion:	October 1985	Index:	3269

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		5 Jan 82

3. INSTALLATION AND LOCATION

Fort Benjamin Harrison, Indiana

4. PROJECT TITLE	5. PROJECT NUMBER
Window Treatment, Insulation (ECIP)	402000

BUILDING LIST

WINDOW TREATMENT & CEILING INSULATION

Bldg. #	SF Roof Insulation	SF Storm Windows	SF Add Thermopane	SF New Windows	Fuel
13	-	780	-	-	Coal
17	8,650	1095	-	-	Coal
28	-	949	-	-	Coal
33	-	374	-	-	Gas
36	18,300	-	-	-	Coal
38	-	196	-	-	Gas
39	-	128	-	-	Gas
43	-	-	262	-	Gas
44	-	-	96	-	Gas
45	-	-	96	-	Gas
46	9,200	-	-	-	Gas
52	2,900	-	-	-	Gas
54	-	992	-	-	Gas
126	-	2,886	-	-	Coal
402	10,000	-	-	3,251	Coal
424	11,000	385	-	-	Gas
425	11,000	385	-	-	Gas
426	11,000	385	-	-	Gas
427	-	-	2,152	-	Coal
428	-	-	259	-	Coal
429	-	-	1,040	-	Coal
430	-	-	1,040	-	Coal
431	-	-	2,080	-	Coal
432	-	-	1,040	-	Coal
433	-	-	900	-	Gas
460	12,200	-	-	613	Gas
466	5,800	-	-	749	Gas
470	-	-	96	-	Gas
500	-	1,406	-	-	#2 Oil
501	4,500	238	-	-	#2 Oil
511	1,100	76	-	-	#2 Oil
529	-	-	1,334	-	Gas
600	-	6,163	-	-	Coal
602	3,600	-	-	-	#2 Oil
604	3,700	401	-	-	Coal
610	9,500	353	-	-	Coal
611	-	738	-	-	Coal
613	-	3,370	-	-	Coal
614	-	289	-	-	Coal
615	-	3,370	-	-	Coal

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		5 Jan 82

3. INSTALLATION AND LOCATION

Fort Benjamin Harrison, Indiana

4. PROJECT TITLE	5. PROJECT NUMBER
Window Treatment, Insulation (ECIP)	402000

BUILDING LIST

WINDOW TREATMENT & CEILING INSULATION

Bldg. #	SF Roof Insulation	SF Storm Windows	SF Add Thermopane	SF New Windows	Fuel
616	2,100	278	-	-	#2 Oil
619	-	167	-	-	#2 Oil
622	1,200	-	-	-	Gas
624	-	132	-	-	Coal
662	-	2,032	-	-	Coal
663	4,500	-	-	1,116	Coal
664	2,700	-	-	889	Coal
665	3,100	-	-	652	Coal
666	-	3,000	-	-	Coal
667	-	3,000	-	-	Coal
668	-	3,000	-	-	Coal
669	-	-	-	636	Coal
670	-	3,000	-	-	Coal
671	-	3,000	-	-	Coal
672	-	3,000	-	-	Coal
700	-	83	-	-	#2 Oil
701	2,200	83	-	-	#2 Oil
703	2,200	83	-	-	#2 Oil
TOTALS	140,450	45,817	10,395	7,906	

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON FY 1985
PROJECT: WINDOW TREATMENT & INSULATION
ECON. LIFE: 25 YRS. DATE: 1 / 5 / 82 PREPARED BY: JLC

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	666,000.
b. Design	$	38,000.
c. Salvage	$	0.
d. Total	$	704,000.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: COAL		
(1) Annual Energy Decrease (+)/Increase (-)		13,556.MBTU
(2) Cost per MBTU	$	5.06/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	68,593./YR.
(4) Differential Escalation Rate (5%) Factor		14.777
(5) Discounted Dollar Decrease/Increase ((3)x(4))		$1,013,600.
b. Type of Fuel:NATURAL GAS		
(1) Annual Energy Decrease (+)/Increase (-)		4,869.MBTU
(2) Cost per MBTU	$	4.21/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	20,498./YR.
(4) Differential Escalation Rate (8%) Factor		20.050
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	410,995.
c. Type of Fuel: NO.2 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		1,336.MBTU
(2) Cost per MBTU	$	14.63/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	19,546./YR.
(4) Differential Escalation Rate (8%) Factor		20.050
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	391,891.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))		$1,816,490.
4. Total Benefits (Sum 2f + 3e)		$1,816,490.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		2.6
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		19,761.
7. E/C Ratio (Line 6 /Line 1a/1000)		30.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	108,638.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		6.1

1. COMPONENT	FY 1984 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		15 Jan 82

3. INSTALLATION AND LOCATION	4. PROJECT TITLE (Rev. 1)
Fort Benjamin Harrison, Indiana	Building 1 Energy Conservation Alterations

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	61027	T104000	4,117

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Primary Facility				3,734
Envelope Improvements	LS			(2,600)
Variable Air Volume (VAV) and Enthalpy Control Economizer System (ECES)	LS			(1,134)
Sub-Total				3,734
Contingency (5%)				187
Total Contract Cost				3,921
Supervision, Inspection & Overhead (5%)				196
Total Requested				4,117

10. DESCRIPTION OF PROPOSED CONSTRUCTION

Work will consist of architectural and mechanical alterations to Building 1, the Finance Center, to improve energy efficiency. All windows will be removed and 90% of the openings will be closed, insulated and finished. The remaining 10% will receive clear, double paned (insulated) window units. The entire outside of the building will receive an insulation layer with a weather resistant surface. Vestibule areas will be created at the south entrance of the first and second floors by adding revolving and double entry doors. Existing air handling units (AHU) will be converted from constant volume to variable air volume (VAV) systems and/or economizer capabilities. Outside air will be reduced to the minimum required. Ductwork will be changed to provide appropriate air distribution. New controls will be installed to operate the improved system.

B/C: 1.8; E/C: 30; Payback: 7.1 years; Savings: 122,674 MBTU, $583,658/year.

11. REQUIREMENTS: This project is required in order to meet the Army's stated goals for energy use reduction in existing facilities. This project is submitted under the Energy Conservation Investment Program (ECIP).

CURRENT SITUATION: The Army Finance Center was designed and constructed in an era when energy was plentiful and inexpensive. As a result the building has large areas of glass which is single pane with loose fitting awning type windows. The walls are a porous concrete block which allows air and water infiltration. The south entrances, through which most people enter and depart, have no vestibule and are composed of double entry doors that never have the opportunity to close at the beginning and end of work hours. This results in massive heat and cooling losses. The constant volume air handling system

1. COMPONENT	FY 19_84 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		15 Jan 82

3. INSTALLATION AND LOCATION

FORT BENJAMIN HARRISON, INDIANA

4. PROJECT TITLE	5. PROJECT NUMBER
BLDG 1 ENERGY CONSERVATION ALTERATIONS (Rev. 1)	T1Ø4ØØØ

requires the same high volume to be moved by the air handling units regardless of how much is actually needed to heat or cool the space. There is no provision for using outside air to cool when conditions are favorable. The present fresh air supply is far in excess of the minimum required which results in far more heating or cooling than actually needed.

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that on EIS pursuant to PL 91-190 is not required.

DANIEL W. FRENCH
MG, USA
Commanding

Estimated Construction Start: April 1984 Index: 2887
Estimated Midpoint of Construction: November 1984 Index: 3052
Estimated Construction Completion: July 1985 Index: 3183

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON BLDG. 1 FY 1985
PROJECT: BLDG. 1 - ENERGY CONSERVATION ALTERATIONS (ECIP)
ECON. LIFE: 15/25 YRS. DATE: 1 / 13 / 82 PREPARED BY: JLC

COST	
1. Non-recurring Initial Capital Costs:	
a. Current Working Estimate	$4,117,000.
b. Design	$ 235,000.
c. Salvage	$ 0.
d. Total	$4,352,000.
BENEFITS	
2. Recurring Benefit/Cost Differential Other Than Energy:	
a. Annual Labor Decrease (+)/Increase (-)	$ 0./YR.
b. Annual Material Decrease (+)/Increase (-)	$ 0./YR.
c. Other Annual Decrease (+)/Increase (-)	$ 26,342./YR.
d. Total Costs	$ 26,342./YR.
e. 10% Discount Factor	9.524
f. Discounted Recurring Cost (d x e)	$ 250,881.
3. Recurring Energy Benefit/Costs:	
a. Type of Fuel: ELECTRICITY (15 YRS)	
(1) Annual Energy Decrease (+)/Increase (-)	5,279.MBTU
(2) Cost per MBTU	$ 1.62/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 8,552./YR.
(4) Differential Escalation Rate (7%) Factor	12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ 105,001.
b. Type of Fuel:ELECTRIC DEMAND (15 YRS)	
(1) Annual Energy Decrease (+)/Increase (-)	0.MBTU
(2) Cost per MBTU	$ 0.00/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 8,747./YR.
(4) Differential Escalation Rate (7%) Factor	12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ 107,396.
c. Type of Fuel: COAL MECHANICAL (15 YRS)	
(1) Annual Energy Decrease (+)/Increase (-)	34,225.MBTU
(2) Cost per MBTU	$ 4.60/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 157,435./YR.
(4) Differential Escalation Rate (5%) Factor	10.798
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$1,699,980.
d. Type of Fuel: COAL ENVELOPE (25 YRS)	
(1) Annual Energy Decrease (+)/Increase (-)	83,170.MBTU
(2) Cost per MBTU	$ 4.60/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 382,582./YR.
(4) Differential Esculation Rate (5%) Factor	14.777
(5) Discounted Dollar Decrease/Increase ((3)x(4)	$5,653,410.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$7,565,790.
4. Total Benefits (Sum 2f + 3e)	$7,816,670.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)	1.8
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))	122,674.
7. E/C Ratio (Line 6 /Line 1a/1000)	30.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$ 583,658.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)	7.1

1. COMPONENT	FY 1984 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		Sept. 1981

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Alter Harrison Village MFH (ECIP)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
			$1290

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Primary Facilities				1,170
Replace Windows	EA	2,174	264.00	(574)
Insulate Ceilings	SF	162,610	.72	(117)
Insulate Walls-Masonry	SF	114,524	1.20	(137)
Insulate Woodwalls-Install Siding	SF	91,334	2.03	(185)
Install Storm Doors	EA	596	186.00	(111)
Weather Strip Doors	EA	596	36.00	(22)
Install Threshold W/Seal	EA	596	40.00	(24)
Sub Total				1,170
Contingency (5%)				59
Total Contract Cost				1,229
Supervision, Inspection and Overhead (5%)				61
Total Requested				1,290

10. DESCRIPTION OF PROPOSED CONSTRUCTION Alteration consists of replacing windows, insulating walls and ceilings, installing vinyl siding, weather stripping, and installing storm doors and threshold on the Harrison Village Military Family Housing (MFH) Complex. The complex is composed of 48 buildings with 270 individual units. Building numbers affected are 1001 through 1048.

11. REQUIREMENT: This project is required in order to meet the Army's stated goals for energy use reduction in existing facilities. This project is submitted under the MFH Energy Conservation Investment Program (ECIP).

CURRENT SITUATION: The housing units were built in 1960 using loose fitting window units which have become looser fitting with age and use. Minimum insulation was provided in the ceiling and no insulation was placed in the walls. The siding is asbestos shingles which has deteriorated and is a maintenance problem. There is no weather stripping and the exterior doors are equipped with wooden screen doors. All of this combines to make the units very high energy wasters.

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

Estimated Construction Start:	1 April 1984	Index 2887
Estimated Midpoint of Construction:	1 October 1984	Index 3035
Estimated Construction Completion:	1 April 1985	Index 3117

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON MFH 1000 AREA FY 1984
PROJECT: ALTER HARRISON VILLAGE MFH (ECIP)
ECON. LIFE: 25 YRS. DATE: 9 / 23 / 81 PREPARED BY: GDC

COST	
1. Non-recurring Initial Capital Costs:	
a. Current Working Estimate	$1,290,000.
b. Design	$ 73,740.
c. Salvage	$ 0.
d. Total	$1,363,740.
BENEFITS	
2. Recurring Benefit/Cost Differential Other Than Energy:	
a. Annual Labor Decrease (+)/Increase (-)	$ 0./YR.
b. Annual Material Decrease (+)/Increase (-)	$ 0./YR.
c. Other Annual Decrease (+)/Increase (-)	$ 14,750./YR.
d. Total Costs	$ 14,750./YR.
e. 10% Discount Factor	9.524
f. Discounted Recurring Cost (d x e)	$ 140,479.
3. Recurring Energy Benefit/Costs:	
a. Type of Fuel: NATURAL GAS	
(1) Annual Energy Decrease (+)/Increase (-)	26,133.MBTU
(2) Cost per MBTU	$ 4.21/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 110,020./YR.
(4) Differential Escalation Rate (8%) Factor	20.050
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$2,205,900.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$2,205,900.
4. Total Benefits (Sum 2f + 3e)	$2,346,380.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)	$ 1.7
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))	26,133.
7. E/C Ratio (Line 6 /Line 1a/1000)	20.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$ 124,770.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)	10.3

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		15 Jan 82

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Building 400 Energy Conservation Alterations

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
		T401000	1259

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Building Envelope Improvements	LS			1142
Contingency (5%)				57
Total Contract Cost				1199
Supervision, Inspection & Overhead (5%)				60
Total Request				1259

10. DESCRIPTION OF PROPOSED CONSTRUCTION : Work will consist of architectural alterations to Building 400, Gates-Lord Hall, to improve energy efficiency. All windows will be removed, most of the openings will be closed, insulated and finished. The remaining will receive tinted, double paned (insulated) window units. The entire outside of the building will receive an insulation layer with a weather resistant surface.

B/C: 1.1; E/C: 15; Payback: 13.3 years; Savings: 18,733 MBTU, $94,789/year.

11. REQUIREMENTS: This project is required in order to meet the Army's stated goals for energy use reduction in existing facilities. This project is submitted under the Energy Conservation Investment Program (ECIP).

CURRENT SITUATION: Building 400 was designed and constructed in an era when energy was plentiful and inexpensive. As a result the building has large areas of glass which is single pane with loose fitting awning type windows. The walls are a porous concrete block which allows air and water infiltration.

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		15 Jan 82

3. INSTALLATION AND LOCATION

Fort Benjamin Harrison, Indiana

4. PROJECT TITLE	5. PROJECT NUMBER
Building 400 Energy Conservation Alterations (ECIP)	T401000

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

DANIEL W. FRENCH
MG, USA
Commanding

Estimated Construction Start:	April 1985	Index: 3117
Estimated Midpoint of Construction:	July 1985	Index: 3183
Estimated Construction Completion:	October 1985	Index: 3269

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON BLDG. 400 FY 1985
PROJECT: BLDG. 400 - ENERGY CONSERVATION ALTERATIONS
ECON. LIFE: 25 YRS. DATE: 1 / 13 / 82 PREPARED BY: JLC

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$1,259,000.	
b. Design	$ 72,000.	
c. Salvage	$ 0.	
d. Total	$1,331,000.	
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: COAL		
(1) Annual Energy Decrease (+)/Increase (-)		18,733.MBTU
(2) Cost per MBTU	$	5.06/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	94,789./YR.
(4) Differential Escalation Rate (5%) Factor		14.777
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$1,400,700.	
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$1,400,700.	
4. Total Benefits (Sum 2f + 3e)	$1,400,700.	
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		1.1
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		18,733.
7. E/C Ratio (Line 6 /Line 1a/1000)		15.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	94,789.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		13.3

2.2.2 INCREMENT G RECOMMENDATIONS

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		Nov. 81

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Install Flow Restrictors(BACH.HSG)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	721, 724		23

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Install Flow Restrictor Shower Heads	EA	841	$25.00	21
Contingency (5%)				1
Total Contract Cost				22
Supervision, Inspection and Overhead (5%)				1
Total Request				23

10. DESCRIPTION OF PROPOSED CONSTRUCTION Project involves replacement of existing free flow shower heads with one which restricts the flow to conserve energy through the reduction of hot water usage. Buildings involved include all bachelor housing (BOQ and BEQ) facilities having showers. Buildings are 208, 210, 214, 221, 224, 225, 226, 227, 230, 401, 402, 420, 421, 427, 429, 430, 431, 437, 438, 442, 443, 445, 446, 447, 448, 449, 450, 453, 537, 538, 539, 613, 615, 662, 666, 667, 668, 670, 671 and 672.

B/C Ratio 8.63; E/C Ratio 171; Payback 1.3 years; Energy Saved 3927.8 MBTU/Yr.

11. Requirement: This project is required in order to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: The present installed shower heads are of the old free flowing variety. Since it is virtually impossible to control the amount of time people spend in the shower, energy savings must be realized by controlling the amount of hot water that flows during the process.

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON BACH. QTRS FY 1982
PROJECT: INSTALL FLOW RESTRICTORS
ECON. LIFE: 15 YRS. DATE: 11 / 3 / 81 PREPARED BY: JLC & ASSOCIATES

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	23,000.
b. Design	$	1,380.
c. Salvage	$	0.
d. Total	$	24,380.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: NO.2 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		639.MBTU
(2) Cost per MBTU	$	8.80/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	5,623./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	73,731.
b. Type of Fuel:COAL		
(1) Annual Energy Decrease (+)/Increase (-)		3,002.MBTU
(2) Cost per MBTU	$	3.72/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	11,167./YR.
(4) Differential Escalation Rate (5%) Factor		10.798
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	120,586.
c. Type of Fuel: NATURAL GAS		
(1) Annual Energy Decrease (+)/Increase (-)		382.MBTU
(2) Cost per MBTU	$	3.23/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	1,234./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	16,178.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	210,496.
4. Total Benefits (Sum 2f + 3e)	$	210,496.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		8.6
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		4,023.
7. E/C Ratio (Line 6 /Line 1a/1000)		175.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	18,025.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		1.3

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		1 Dec 81

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Alter Clinic HVAC

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	51010		93

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Primary Facility				
Alter HVAC System	Job	1	85,000	85
Contingency (5%)				4
Total Contract Cost				89
Supervision, Inspection and Overhead (5%)				4
Total Request				93

10. DESCRIPTION OF PROPOSED CONSTRUCTION Work will consist of mechanical alterations to Building 300, the Hawley Clinic to improve energy efficiency. The major alteration is to convert the reheat zones to variable air volume (VAV) zones, provide an enthalpy control economizer system (ECES), and separate the emergency area from the large clinic fan system to allow independent operation. The work will be designed to allow the hospital to return to full operation with minor adjustments to controls.
E/C: 168; B/C: 5.5; Payback: 1.9 years; 15,615 MBTU/year saved

11. REQUIREMENT: This project is required to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: The Hawley clinic was originally designed and constructed as a fully operating 24 hour per day hospital. Since that time, a change in Department of Defense policy regarding the number of hospitals in a given area has reduced the operation to a 5 day per week clinic and administration with a small 24 hour per day emergency staff. The current constant volume air system requires reheat when the cooling load falls below what is being delivered. This results in simultaneous heating and cooling which is not required for humidity control. At present, the entire hospital HVAC must be operated to accomodate the small 24 hour per day emergency operation. There is no method of isolating the area so the rest of the system can be set back. The second floor is unoccupied most of the time and under the present system must be conditioned to the same level as the first floor. The above deficiencies, many of which are caused by the change in operation since design and construction, result in a waste of energy.

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		1 Dec 81

3. INSTALLATION AND LOCATION

Fort Benjamin Harrison, Indiana

4. PROJECT TITLE	5. PROJECT NUMBER
Alter Clinic HVAC	

IMPACT IF NOT PROVIDED: If this project is not completed energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

		INDEX
Estimated Construction Start	1 May 82	2459
Estimated Midpoint of Construction	1 July 82	2502
Estimated Construction Completion	1 Sep 82	2556

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON BLDG. 300 FY 1982
PROJECT: ALTER CLINIC HVAC
ECON. LIFE: 15 YRS. DATE: 12 / 1 / 81 PREPARED BY: JLC & ASSOCIATES

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	93,000.
b. Design	$	5,340.
c. Salvage	$	0.
d. Total	$	98,340.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: COAL		
(1) Annual Energy Decrease (+)/Increase (-)		10,668.MBTU
(2) Cost per MBTU	$	3.80/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	40,538./YR.
(4) Differential Escalation Rate (5%) Factor		10.798
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	437,734.
b. Type of Fuel:ELECTRICITY		
(1) Annual Energy Decrease (+)/Increase (-)		4,947.MBTU
(2) Cost per MBTU	$	1.27/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	6,283./YR.
(4) Differential Escalation Rate (7%) Factor		12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	77,139.
c. Type of Fuel: DEMAND REDUCTION		
(1) Annual Energy Decrease (+)/Increase (-)		0.MBTU
(2) Cost per MBTU	$	0.00/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	1,960./YR.
(4) Differential Escalation Rate (7%) Factor		12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	24,065.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	538,937.
4. Total Benefits (Sum 2f + 3e)	$	538,937.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		5.5
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		15,615.
7. E/C Ratio (Line 6 /Line 1a/1000)		168.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	48,781.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		1.9

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		15 Jan 82

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Install Blowdown Heat Recovery

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
			26.5

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Install Blowdown Heat Recovery System	LS			24
Contingency (5%)				1.2
Total Contract				25.2
Supervision, Inspection and Overhead (5%)				1.3
Total Request				26.5

10. DESCRIPTION OF PROPOSED CONSTRUCTION: Work involves installing a blowdown heat recovery system on the boilers in the Central Plant (Building 2). System is to include a flash tank, a heat exchanger and associated piping.

B/C: 6.2; E/C: 160; Payback: 1.6 years; Savings: 4249 MBTU, $16,146/year.

11. REQUIREMENT: This project is required to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: The blowdown water and waste heat is presently rejected into the sewer system. No method exists to reclaim any of the waste heat.

IMPACT IF NOT PROVIDED: If this project is not completed, energy waste will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON BLDG. 2 FY 1982
PROJECT: BLOWDOWN HEAT RECOVERY - BLDG. 2
ECON. LIFE: 15 YRS. DATE: 1 / 15 / 82 PREPARED BY: JLC

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	26,490.
b. Design	$	1,510.
c. Salvage	$	0.
d. Total	$	28,000.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: COAL		
(1) Annual Energy Decrease (+)/Increase (-)		4,249.MBTU
(2) Cost per MBTU	$	3.80/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	16,146./YR.
(4) Differential Escalation Rate (5%) Factor		10.798
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	174,347.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	174,347.
4. Total Benefits (Sum 2f + 3e)	$	174,347.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		6.2
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		4,249.
7. E/C Ratio (Line 6 /Line 1a/1000)		160.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	16,146.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		1.6

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		November 81

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Install Flow Restrictors (MFH)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	71115		10.5

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Install Flow Restrictor Showerheads	Ea.	380	25	9.5
Contingency (5%)				0.5
Total Contract Cost				10.0
Supervision, Inspection and Overhead (5%)				0.5
Total Request				10.5

10. DESCRIPTION OF PROPOSED CONSTRUCTION Project involves replacement of existing free flow showerheads with one which restricts the flow to conserve energy through the reduction of hot water usage. Buildings involved include all family housing units on post.

B/C Ratio: 7.6, E/C Ratio: 158.2; Payback: 1.62 years; Energy Saved: 1756.5 MBTU/year.

11. REQUIREMENT: This project is required in order to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: The present installed shower heads are of the old free flowing variety. Since it is virtually impossible to control the amount of time people spend in the shower, energy savings must be realized by controlling the amount of hot water that flows during the process.

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON MFH FY 1982
PROJECT: INSTALL FLOW RESTRICTORS
ECON. LIFE: 15 YRS. DATE: 11 / 3 / 81 PREPARED BY: JLC & ASSOCIATES

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	10,500.
b. Design	$	600.
c. Salvage	$	0.
d. Total	$	11,100.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: ELECTRIC		
(1) Annual Energy Decrease (+)/Increase (-)		20.MBTU
(2) Cost per MBTU	$	3.12/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	63./YR.
(4) Differential Escalation Rate (7%) Factor		12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	770.
b. Type of Fuel:NATURAL GAS		
(1) Annual Energy Decrease (+)/Increase (-)		1,597.MBTU
(2) Cost per MBTU	$	3.23/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	5,157./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	67,615.
c. Type of Fuel: NO.2 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		140.MBTU
(2) Cost per MBTU	$	8.80/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	1,230./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	16,131.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	84,515.
4. Total Benefits (Sum 2f + 3e)	$	84,515.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		7.6
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		1,756.
7. E/C Ratio (Line 6 /Line 1a/1000)		167.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	6,450.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		1.6

1. COMPONENT	FY 19 82 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		11 Jan. 1982

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Install Programmable Thermostats (MFH)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
			59

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Install Programmable Thermostats	EA	353	$150	53
Contingency (5%)				3
Total Contract				56
Supervision, Inspection and Overhead (5%)				3
Total Request				59

10. DESCRIPTION OF PROPOSED CONSTRUCTION

Project involves installing programmable thermostats in every Military Family Housing unit on post. Thermostats are to be the preset sealed units programmable by the DFAE maintenance personnel. See 1391C for list of quarters numbers.

At Present:
B/C: 8.7 ; E/C: 151; Payback: 1.4 yers., Savings: 8896 MBTU, $41,344/yr.
If Converted to Natural Gas:
B/C: 5.3; E/C: 151; Payback 2.3 yrs.; Savings: 8896 MBTU; $25,265/yr.

11. REQUIREMENT: This project is required to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: The present thermostats are the standard occupant operated variety which do not have the capability to provide night setback automatically.

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		11 Jan. 1982

3. INSTALLATION AND LOCATION
Fort Benjamin Hearrison, Indiana

4. PROJECT TITLE	5. PROJECT NUMBER
Install Programmable Thermostats (MFH)	

1391C

Building List

Typical Bldg. NR	Buildings in Group
404	--
405 ABCD	406
411 AV	--
506	505 507 508
512	--
643 AB	644 645 647 648 648 650 651 653 654 656 658 659 660
646	652 655 657 661
1002 ABCDE	1003 1010 1014 1016 1019 1021 1025 1027 1028 1030 1034 1041 1047
1006 ABCDEFG	1001 1007 1008 1009 1011 1013 1017 1020 1026 1032 1035 1040 1044 1046 1048
1015 ABCD	1012 1018 1024 1029 1033 1037 1038 1043 1045
1031 ABCDEF	1004 1004 1022 1023 1036 1039 1042

DD FORM 1 DEC 76 1391c

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON FY 1982
PROJECT: INSTALL PROGRAMMABLE THERMOSTATS (MFH)
ECON. LIFE: 15 YRS. DATE: 1 / 11 / 82 PREPARED BY: JLC

COST

1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	59,000.
b. Design	$	3,400.
c. Salvage	$	0.
d. Total	$	62,400.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: NO.2 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		2,284.MBTU
(2) Cost per MBTU	$	9.88/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	22,566./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	295,884.
b. Type of Fuel:NATURAL GAS		
(1) Annual Energy Decrease (+)/Increase (-)		6,612.MBTU
(2) Cost per MBTU	$	2.84/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	18,778./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	246,218.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	542,103.
4. Total Benefits (Sum 2f + 3e)	$	542,103.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		8.7
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		8,896.
7. E/C Ratio (Line 6 /Line 1a/1000)		151.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	41,344.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		1.4

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON FY 1982
PROJECT: INSTALL PROGRAMMABLE THERMOSTATS (MFH) - NG CONVERSION
ECON. LIFE: 15 YRS. DATE: 1 / 11 / 82 PREPARED BY: JLC

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	59,000.
b. Design	$	3,400.
c. Salvage	$	0.
d. Total	$	62,400.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: NATURAL GAS		
(1) Annual Energy Decrease (+)/Increase (-)		8,896.MBTU
(2) Cost per MBTU	$	2.84/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	25,265./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	331,270.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	331,270.
4. Total Benefits (Sum 2f + 3e)	$	331,270.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		5.3
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		8,896.
7. E/C Ratio (Line 6 /Line 1a/1000)		151.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	25,265.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		2.3

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		15 Jan 82

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Add HWH Insulation (MFH)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
			10

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Install 1-1/2" Fiberglass Blanket	EA	349	25	8.5
Insulate Building 900 HWH	LS			.5
Subtotal				9.0
Contingency (5%)				.5
Total Contract Cost				9.5
Supervision, Inspection & Overhead (5%)				.5
Total Request				10.0

10. DESCRIPTION OF PROPOSED CONSTRUCTION : Work involves installing a 1-1/2 inch fiberglass blanket over 348 gas and one electric hot water heaters in all of family housing except Building 900. Building 900 has one large central HWH and it is to be insulated with 2" of rigid.

B/C: 4.3; E/C: 121; Payback: 2.9; Savings: 1214 MBTU, $3441/year.

11. REQUIREMENT: This project is required to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: The hot water heaters (HWH) in most of the quarters have only that minimum insulation furnished by the manufacturer. The HWH in Building 900 has no insulation and results in huge energy losses.

IMPACT IF NOT PROVIDED: If this project is not completed, energy waste will continue at the present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON MFH FY 1982
PROJECT: INSULATE HW HEATERS (MFH)
ECON. LIFE: 15 YRS. DATE: 1 / 15 / 82 PREPARED BY: JLC

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	10,000.
b. Design	$	600.
c. Salvage	$	0.
d. Total	$	10,600.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: ELECTRICITY		
(1) Annual Energy Decrease (+)/Increase (-)		4.MBTU
(2) Cost per MBTU	$	1.27/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	5./YR.
(4) Differential Escalation Rate (7%) Factor		12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	63.
b. Type of Fuel:NATURAL GAS		
(1) Annual Energy Decrease (+)/Increase (-)		1,210.MBTU
(2) Cost per MBTU	$	2.84/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	3,436./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	45,058.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	45,121.
4. Total Benefits (Sum 2f + 3e)	$	45,121.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		4.3
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		1,214.
7. E/C Ratio (Line 6 /Line 1a/1000)		121.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	3,442.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		2.9

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		21 Dec 81

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Replace 37 Oil Furnaces

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	Various		203

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Repair by Replacement				
Replace 37 oil furnaces: Provide exterior and interior piping to convert fuel to natural gas	EA	37	Varies	184
Contingency (5%)				9
TOTAL CONTRACT				193
Supervision, Inspection & Overhead (5%)				10
TOTAL REQUEST				203

10. DESCRIPTION OF PROPOSED CONSTRUCTION: Replace the existing oil furnaces in 37 buildings with new gas furnace. Provide interior piping, exterior piping to connect to the gas main and a regulator. Buildings receiving replacements are as follows: 6, 33, 43, 116, 332, 435, 479, 481, 700, 701, 703, 803, 501, 616, 200, 204, 206, 207, 228, 229, 208, 210, 214, 221, 224, 225, 226, 227, 230, 212, 213, 222, 223, 218, 219, 220.

B/C Ratio: 9.4; E/C Ratio: 24; Payback: 1.3 years; Savings: 4,945 MBTU/yr $154,830/yr.

11. REQUIREMENT: This project is required in order to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: Due to building retrofit and energy conservation work, the present oil furnaces are now grossly oversized and inefficient. Installation of a properly sized oil furnace would result in significant energy savings, but when comparing current costs of $9.88/MBTU for oil with $2.84/MBTU for natural gas, the need to convert to gas at the same time becomes readily apparent.

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON FY 1982
PROJECT: REPLACE OIL FURNACES
ECON. LIFE: 15 YRS. DATE: 12 / 18 / 81 PREPARED BY: JLC

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	203,000.
b. Design	$	12,200.
c. Salvage	$	0.
d. Total	$	215,200.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: NO.2 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		19,998.MBTU
(2) Cost per MBTU	$	9.88/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	197,580./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))		$2,590,670.
b. Type of Fuel:NATURAL GAS		
(1) Annual Energy Decrease (+)/Increase (-)		-15,053.MBTU
(2) Cost per MBTU	$	2.84/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	-42,751./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))		$ -560,545.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))		$2,030,130.
4. Total Benefits (Sum 2f + 3e)		$2,030,130.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		9.4
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		4,945.
7. E/C Ratio (Line 6 /Line 1a/1000)		24.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	154,830.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		1.3

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		23 Dec 81

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Replace/convert oil boilers (MFH)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
			40.5

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Replace boilers, typical unit 646 group	EA	5	6,000	30
Replace boiler, building 900	EA	1	6,500	6.5
SUBTOTAL				36.5
Contingency (5%)				2
TOTAL CONTRACT COST				38.5
Supervision, inspection and overhead (5%)				2
TOTAL REQUESTED				40.5

10. DESCRIPTION OF PROPOSED CONSTRUCTION Replace the existing oil boilers in Family Housing quarters 646, 652, 655, 657, 661, and 900. Provide interior and exterior piping, a meter and a regulator.

B/C Ratio: 7.8; E/C Ratio : 24; Payback: 1.6 years
Savings: 956 MBTU, $25,624/yr.

11. Requirement: This project is required in order to help meet the Army's stated goals for energy use reduction in existing facilities.

Current Situation: The present oil boilers are grossly oversized for the load since the housing units have been insulated and the windows have been replaced with double glazed energy efficient assembles. The oversizing makes the boilers very inefficient. Installation of a properly sized oil boiler would result in the same energy savings, but when comparing current costs of $9.88 per MBTU for oil with $2.84 per MBTU for gas, the need to convert to gas at the same time becomes readily apparent. The installation must include a meter to ensure proper accounting.

Impact if not Provided: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON FY 1982
PROJECT: REPLACE/CONVERT OIL BOILERS (MFH)
ECON. LIFE: 15 YRS. DATE: 12 / 23 / 81 PREPARED BY: JLC

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	40,500.
b. Design	$	2,400.
c. Salvage	$	0.
d. Total	$	42,900.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: NO.2 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		3,254.MBTU
(2) Cost per MBTU	$	9.88/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	32,150./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	421,545.
b. Type of Fuel:NATURAL GAS		
(1) Annual Energy Decrease (+)/Increase (-)		-2,298.MBTU
(2) Cost per MBTU	$	2.84/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	-6,526./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	-85,573.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	335,971.
4. Total Benefits (Sum 2f + 3e)	$	335,971.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		7.8
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		956.
7. E/C Ratio (Line 6 /Line 1a/1000)		24.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	25,623.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		1.6

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		15 Jan. 82

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Replace No. 2 Oil Boilers With Central Plant Steam

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
			74

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Convert Four Buildings from No. 2 Oil to Central Plant Steam	LS			67
Contingency (5%)				3
Total Contract				70
Supervision, Inspection and Overhead (5%)				4
Total Request				74

10. DESCRIPTION OF PROPOSED CONSTRUCTION : Work consists of removing No. 2 oil boilers in Buildings 54, 433, 602, and 609, installing heat exchangers, steam controls and condensate pumps and constructing underground steam line required to convert the buildings to the central plant main lines.

B/C: 8.5; E/C: 21.6; Payback: 1.6 years; Savings: 1600 MBTU, $47,394/year.

11. REQUIREMENT: This project is required to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: At present, the buildings have individual systems fueled with No. 2 oil which currently costs $9.88/MBTU. Central plant steam is available which currently costs $3.80/MBTU. Some of the systems are oversized which leads to part load inefficiencies which can also be corrected during the conversion.

IMPACT IF NOT PROVIDED: If this project is not completed, energy waste will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON FY 1982
PROJECT: REPLACE OIL BOILERS WITH C.P. STEAM
ECON. LIFE: 15 YRS. DATE: 1 / 15 / 82 PREPARED BY: JLC

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	74,000.
b. Design	$	4,000.
c. Salvage	$	0.
d. Total	$	78,000.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: NO.2 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		6,795.MBTU
(2) Cost per MBTU	$	9.88/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	67,135./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	880,269.
b. Type of Fuel:COAL		
(1) Annual Energy Decrease (+)/Increase (-)		-5,195.MBTU
(2) Cost per MBTU	$	3.80/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	-19,741./YR.
(4) Differential Escalation Rate (5%) Factor		10.798
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	-213,163.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	667,106.
4. Total Benefits (Sum 2f + 3e)	$	667,106.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		8.6
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		1,600.
7. E/C Ratio (Line 6 /Line 1a/1000)		22.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	47,394.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		1.6

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		18 Dec 81

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Replace Oil Furnace (MFH)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	71113		4.7

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Replace Furnace	Job	1	4300	4.3
Sub Total				4.3
Contingency (5%)				.2
TOTAL CONTRACT COST				4.5
Supervision, Inspection and Overhead (5%)				.2
TOTAL REQUESTED				4.7

10. DESCRIPTION OF PROPOSED CONSTRUCTION: Replace the existing oil furnace with a new gas furnace in family housing unit 512. Provide new interior piping, exterior piping to connect to the gas main and a meter and regulator.

B/C Ratio: 6.4; E/C Ratio: 15.7; Payback: 1.9 years; Savings: 74 MBTU, $2,435/yr.

11. REQUIREMENT: This project is required in order to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: The present oil furnace is capable of producing 180,000 BTUH. Since insulation of the unit, the block load has been reduced from 140,000 to 86,000 BTUH. The oversizing on the furnace makes it very inefficient. Installation of a properly sized oil furnace would result in significant energy savings, but when comparing current costs of $9.88 per MBTU for oil with $2.84 per MBTU for gas, the need to convert to gas at the same time becomes readily apparent. The installation must include a meter to ensure proper accounting.

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON FY 1982
PROJECT: REPLACE OIL FURNACE (MFH)
ECON. LIFE: 15 YRS. DATE: 12 / 18 / 81 PREPARED BY: JLC

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	4,700.
b. Design	$	300.
c. Salvage	$	0.
d. Total	$	5,000.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: NO.2 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		316.MBTU
(2) Cost per MBTU	$	9.88/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	3,122./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	40,937.
b. Type of Fuel:NATURAL GAS		
(1) Annual Energy Decrease (+)/Increase (-)		-242.MBTU
(2) Cost per MBTU	$	2.84/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	-687./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	-9,012.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	31,925.
4. Total Benefits (Sum 2f + 3e)	$	31,925.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		6.4
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		74.
7. E/C Ratio (Line 6 /Line 1a/1000)		16.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	2,435.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		1.9

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		4 Jan 82

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Convert Oil Boilers To CP Steam MFH

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
			119

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Convert Oil Boilers to Central Plant Steam	Ea	15	7200	108
Contingency (5%)				5.4
Total Contract Cost				113.4
Supervision, Inspection and Overhead (5%)				5.6
Total Request				119.

10. DESCRIPTION OF PROPOSED CONSTRUCTION: Replace the existing oil boilers in family housing units 404, 405 A, B, C, D, 406 A, B, C, D, 411 A & B, 505, 506, 507, and 508 with steam heat exchangers connected to central plant steam. Provide a meter to each building or group of buildings on an isolated lateral.

B/C Ratio: 3.6; E/C Ratio: 15, Payback: 3.6 years; Savings: 1829 MBTU, $32,869/year.

11. REQUIREMENT: This project is required to conserve utility funds and help the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: The present oil boilers were installed when the heating block load was much larger than at present. Since that time ceiling insulation and now double glazed insulated windows have been installed which makes the equipment far oversized and inefficient. Installation of a properly sized oil boiler would result in about the same energy savings, but when comparing the current costs of $9.88/MBTU for #2 oil to $3.80/MBTU for coal, the need to convert at the same time becomes readily apparent. The installation must include meters to ensure proper accounting.

IMPACT IF NOT PROVIDED: If this project is not completed, utility costs and energy consumption will continue at its present rate as the costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT BENJAMIN HARRISON MFH FY 1982
PROJECT: OIL TO COAL (MFH)
ECON. LIFE: 15 YRS. DATE: 1 / 4 / 82 PREPARED BY: JLC

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	119,000.
b. Design	$	7,000.
c. Salvage	$	0.
d. Total	$	126,000.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: NO.2 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		4,263.MBTU
(2) Cost per MBTU	$	9.88/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	42,118./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	552,257.
b. Type of Fuel:COAL		
(1) Annual Energy Decrease (+)/Increase (-)		-2,434.MBTU
(2) Cost per MBTU	$	3.80/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	-9,249./YR.
(4) Differential Escalation Rate (5%) Factor		10.798
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	-99,873.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	452,384.
4. Total Benefits (Sum 2f + 3e)	$	452,384.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		3.6
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		1,829.
7. E/C Ratio (Line 6 /Line 1a/1000)		15.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	32,869.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		3.6

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		23 Dec 81

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Benjamin Harrison, Indiana	Boiler Conversion (MFH)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
			74

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Convert boilers from #2 oil to natural gas	EA	28	$2,400	67.2
Contingency (5%)				3.3
TOTAL CONTRACT COST				70.5
Supervision, inspection and overhead (5%)				3.5
TOTAL REQUEST				74

10. DESCRIPTION OF PROPOSED CONSTRUCTION Install burner conversion units on 28 oil boilers to allow firing with natural gas. The 14, two-family units are as follows: 643, 644, 645, 647, 648, 649, 650, 651, 653, 654, 656, 658, 659, 660. Provide and install required piping, regulators and meters.

B/C Ratio: 12.1; Payback 1.03 years; Savings: $68,795/yr

11. Requirement: This project is required as an investment to save utilities funds.

Current Situation: The boilers are presently fired using #2 oil which costs $9.88 per MBTU. The same heat can be provided by natural gas which is readily available for $2.84 per MBTU. This huge disparity in cost allows a project which will pay for itself in slightly over one year.

Impact if not Provided: The unnecessary expenditure of utilities funds will continue at the present rate.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

FAMILY HOUSING
BOILER CONVERSION
FORT BENJAMIN HARRISON

Typical Unit 643 (2 family)

643	651
644	653
645	654
647	656
648	658
649	659
650	660

The 28 boilers in this group should be converted to natural gas as soon as possible. While we know this will save some energy due to reduction of the input rate from the present 67 percent oversizing, the amount is difficult to quantify because of the unknown conditions of the boilers in the units not included in the EEAP survey. However, the conversion can be shown to be attractive financially without claiming any energy savings. The following analysis is for conversion of all 28 boilers on that basis, using FY 82 costs and savings.

Economic Analysis: Convert 28 boilers from #2 oil to natural gas.

Gas Conversion Unit	$1,500
Labor, Misc. piping	500
TOTAL	$2,000

$2,000 x 1.2 (OH&P) = $2,400
$2,400 x 28 = 67,000
For CWE, 67,200 x 1.05^2 = 70,560
Design (6%) = 4,240
TOTAL $74,800

Annual Savings:

#2 oil	9772 MBTU x 9.88 =	$96,547
gas	9772 MBTU x 2.84 =	$27,752
		$68,795

Discounted Dollar Value Using ECIP Criteria (15 yrs, 8%):

$68,795 x 13.112 = $902,040
B/C = 12.1
Payback = 1.03

3.0 CURRENT AND FUTURE ENERGY USAGE SUMMARY

3.0 Current and Future Energy Usage Summary

The intent of this section and the tables and graphs is to depict past consumption trends and to predict future consumption with regard to FY85 goals. As the graphs illustrate on pp 3-18 and 3-19, FBH will exceed their FY85 goal through the implementation of proposed ECIPS. As stated in Section 1.0 of this Executive Summary, the previous ECIPs, maintenance, and repair and energy management items have contributed to the decrease in basewide consumption below that of FY75 base year.

In addition, group (Section 3.1.1) is presented, and individual (Section 3.1.2) building energy consumption is calculated for existing typical facilities this section. New construction energy consumption projections are presented in Section 3.0 of Volume 2, Appendix 1 (building lists). These individual building consumption charts depict high energy consumers and provide load profiles for each typical facility.

Monthly tables and graphs on historical energy consumption appear in Volume 1, Section 3; OMA and MFH consumption are presented independently, as well as electric KW demand and electrical consumption (KWH).

3.1 Historical Energy Consumption:

Basewide energy consumption from FY75 - FY81 is presented in this section according to fuel type and electricity. The intent of the tables and graphs in this section is to depict past consumption trends and to identify areas for potential energy conservation measures.

3.1.1 Group Energy Consumption: Figure 3.1.1-A presents the distribution of FY75 energy consumption among categories. These categories include the following:

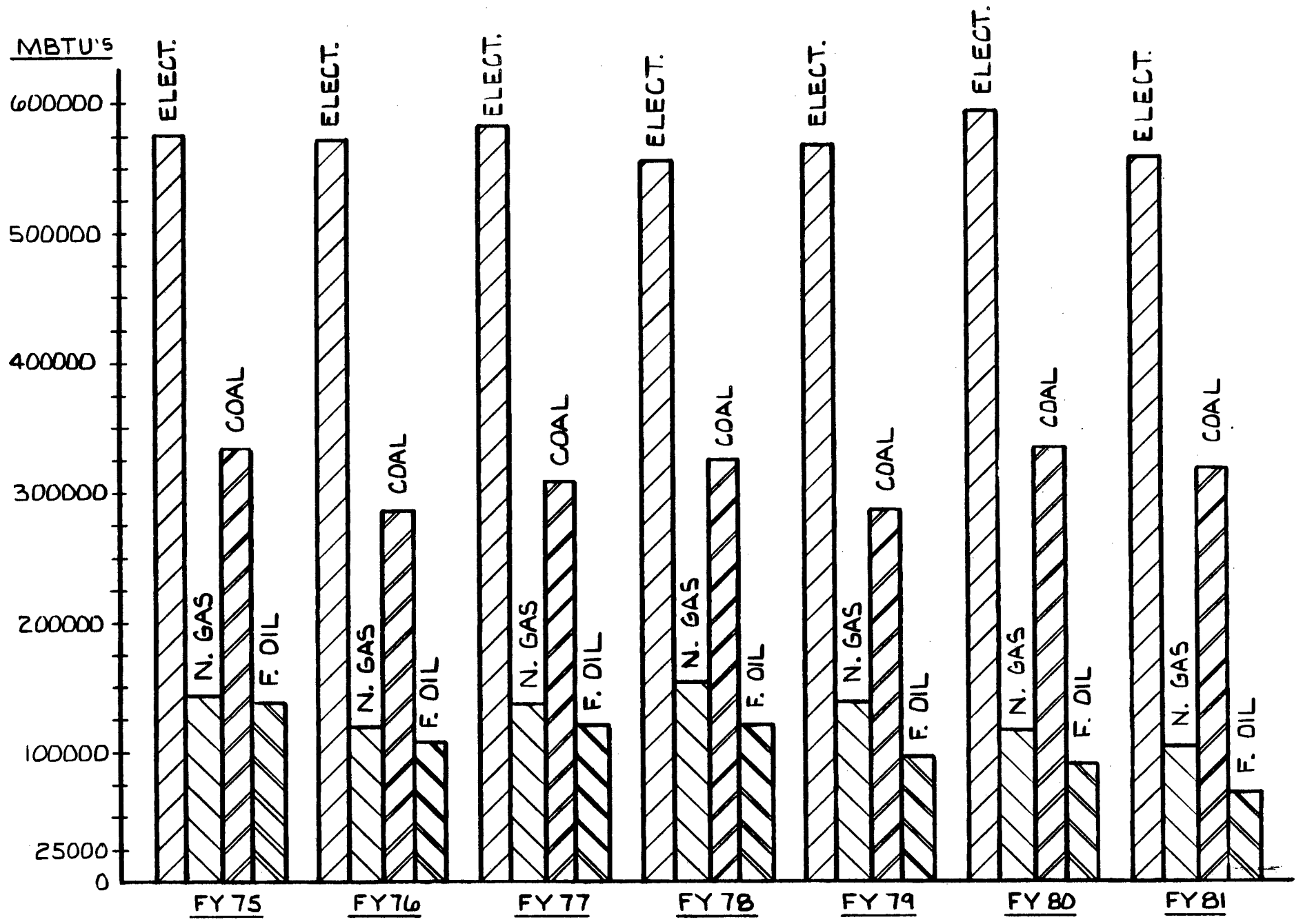
OMAR - Remote reserve centers
Medical - Categories 610 and 141
Maintenance and Reserve - Categories 171, 214, 218, 219
Storage - Categories 442, 422, 713, 714
Community & Utilities - Categories 723, 740, 811, 833, 841, 844, 890
MFH - Category 711
Bachelor Housing - Categories 721 and 724
Building 1
Building 400

Group energy consumption represents the impact of various facilities on basewide energy consumption. For example, Building 1, consumed 19.1% of the total basewide consumption in FY75. Therefore, through energy conservation measures on this individual building, the total future basewide energy requirements can be substantially reduced. Likewise, community facilities, such as bowling centers and clubs, consumed 34.6% of the basewide consumption and represent an area for potential energy conservation measures.

3.1 Fort Benjamin Harrison Total Energy Consumption (MBTU'S)

	Electrical		Natural Gas		Coal	Purch. Steam	#2 Fuel Oil		LPG	
	OMA	OMAR	OMA	OMAR	OMA	OMAR	OMA	OMAR		Total MBTU'S
FY 75	541418.	33733.	125050.	20800.	336147.	5005.	108775.	24700.	1423.	1197051.
FY 76	532150.	41006.	106816.	20920.	291937.	4801.	80036.	28452.	1799.	1107917.
FY 77	543332.	39858.	114562.	19482.	309304.	2224.	91993.	29607.	969.	1151331.
FY 78	518300.	36238.	132726.	21288.	325938.	3376.	98170.	24877.	1381.	1162294.
FY 79	530398.	35252.	119731.	19060.	283167.	3105.	70328.	27787.	1191.	1090019.
FY 80	559735.	33014.	97998.	18776.	330320.	2369.	62950.	26785.	1073.	1133020.
FY 81	514901.	43999.	85150.	17069.	318400.	10677.	51800.	15912.	*1306.	1059214.

*Data not available; consumption averaged according to previous years' consumpton.
Data taken from Facilities Engineering Technical Data Reports.



* LPG AND STEAM NOT GRAPHED DUE TO SMALL QUANTITY (LESS THAN 12,000 MBTU's)

TOTAL ENERGY CONSUMPTION – FORT BENJAMIN HARRISON

3.1-A

GROUP ENERGY CONSUMPTION
(FY 75)

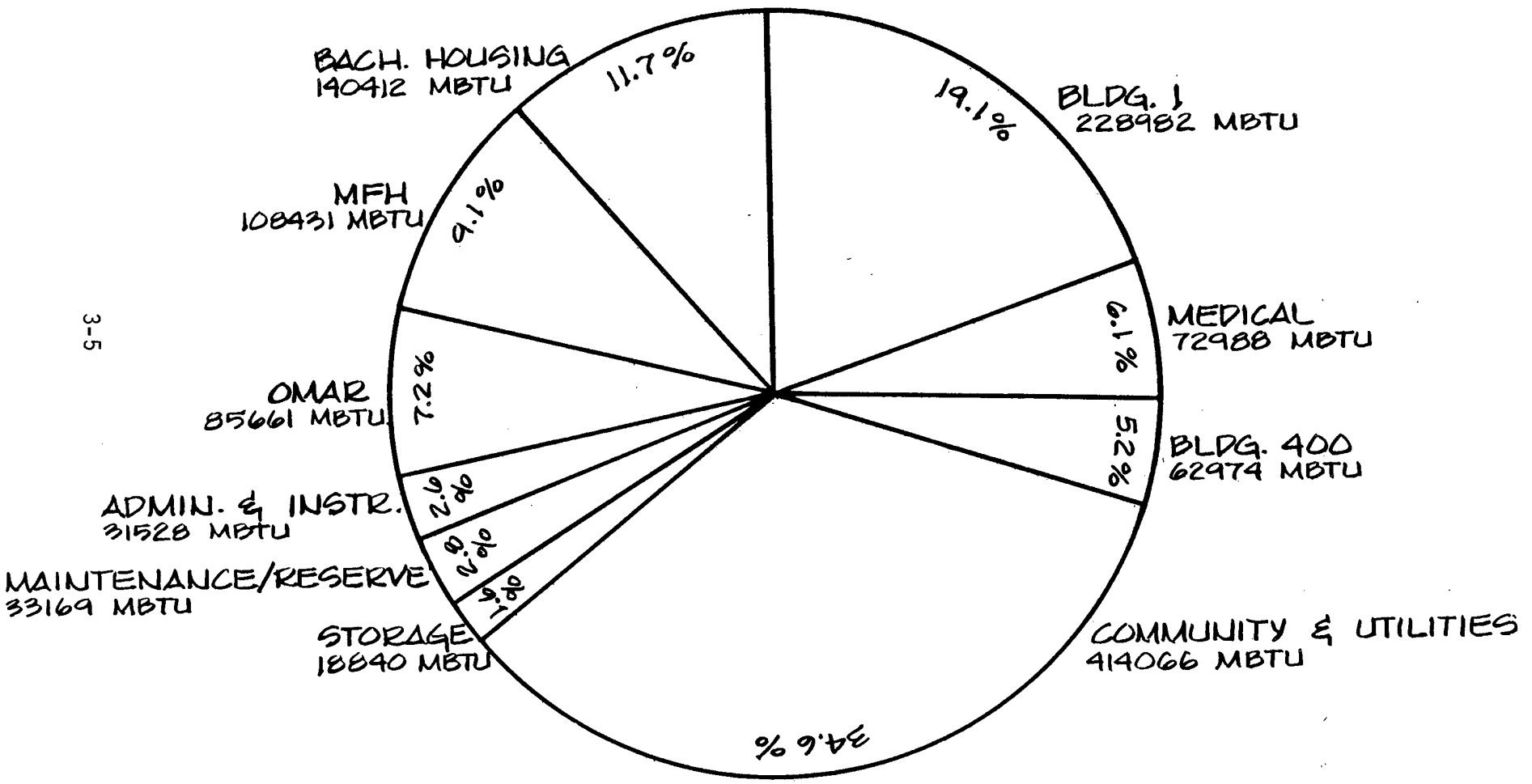


FIG. 3.1.1-A

3.1.2 Individual Building Energy Consumption: Utilizing FY75 as a base year, energy requirements for typical facilities have been simulated through the use of computerized energy program and/or metered data. The tables on pp 3-8 through pp 3-10 summarize these energy requirements and provide load profiles to identify high energy consumers.

3.1.3 Energy Consumption Summary: Basewise energy consumption (FY75 - FY81) is presented in this section with cost, basewide facilities total square footage, MBTU's consumed, and TRADOC goals. FY75 is utilized as the reference year, and FY76 - FY81 energy and cost data are compared to this reference year.

3.1.2 KEY FOR ENERGY CONSUMPTION TABLE FOR EXISTING (TYPICAL) FACILITIES

Building # - identification number used by military.

Window Area - Total window area (square feet) for each building.

Window to floor ratio - window area divided by the floor area.

* (Heat Cap.) - HVAC Design heat output capacity in MBTU's.

* (Cool Cap.) - HVAC Design heat absorption capacity in MBTU's.

Dom. Wtr. Htr. Capacity - (Process Load) storage capacity - gallons of hot water and the type of fuel used.

Process Systems - Fuel consumption (MBTU's/square feet) for other process loads.

Kwatt Demand - (Kilowatt Demand) the peak or highest requirement for electricity, on an hourly basis, for the building.

Peak Day & Time - As a result of computer analysis, this is the electrical peak on an hourly basis.

Elec. Per Yr - Electrical consumption (kilowat hours per year) per square feet.

Peak Cooling Load - The peak or highest requirement for cooling on an hourly basis in KBTU's.

Cooling Load - Cooling requirements for the building per year (MBTU's/sq. ft.) calculated by computer analysis.

Peak Day & Time - As a result of computer analysis, this is the cooling peak on an hourly basis.

Heating Load - Heating requirements for the building per year (MBTU's/sq. ft.) calculated by computer analysis.

MBTU's/square feet nat. gas - natural gas requirements for the building per year (except process loads).

MBTU's/square feet fuel oil - fuel oil requirements for the building per year (except process loads).

MBTU's/square feet steam - steam requirements for the building per year (except process loads).

* This information was obtained from survey data or heating and cooling load calculations. If load calculations were utilized, an additional 5% was added to estimate the mechanical system capacity.

FORT BENJAMIN HARRISON

3.1.2 ENERGY CONSUMPTION TABLE FOR EXISTING (TYPICAL) FACILITIES

BLDG. CHARACTERISTICS			HVAC DESIGN		PROCESS LOADS		ELECTRICAL				HEATING AND COOLING LOADS					FUEL CONSUMPTION		
Bldg.#	Window Area (Sq.Ft.)	Window Floor Ratio	Heat Cap. MBTU's	Cool Cap. MBTU's	Dom. Wtr Htr Capacity (Gals.)	Process Systems MBTU/SF	KWatt Demand	Peak Date	Peak Time	Elec Per Yr KWH	Peak Cooling Load KBTU	Peak Date	Peak Time	Cooling Load MBTU'S/ Sq. Ft.	Heating Load MBTU'S/ Sq. Ft.	Nat Gas MBTU'S/ Sq. Ft.	Fuel Oil MBTU'S/ Sq. Ft.	Steam MBTU'S/ Sq. Ft.
405	822	.085	.275	None	200-N. Gas	.023	10			3.60					.084		.139	
411	590	.122	.186	None	100-N. Gas	.023	7			4.80					.105		.173	
420	6,345	.165	CP	None	1190-Steam	.030	73			4.38					.051			
424	381	.036	.795	.072	52-Elec.	.0006	50	1-16	2AM	11.50	9	7- 1	12M		.078		.131	
427	2,152	.087	CP	1.000	504-Steam	.014	76	7- 1	12M	9.74	712	7- 1	12M		.031			.035
428	259	.049	CP	.236	20-Elec.	.002	14	7- 1	12M	8.42	256	7- 1	12M	.019SIM	.104			.106
429	1,047	.093	CP	.252	300-Steam	.014	60	7- 1	12M	8.42	575	7- 1	12M	.01 SIM	.031			.035
*431	2,094	.093	CP	.506	300-Steam	.014	60	7- 1	12M	8.42	575	7- 1	12M	.01 SIM	.031			.035
433	900	.080	.502	.305	52-Elec.	.002	35	1-16	2AM	7.83	53	7- 1	12M		.027		.045	
434	439	.049	CP	.210	66-Elec.	.001	23	8-18	3PM	9.68	173	7-20	4PM		.046			.047
*443	465	.099	.450	None	85-#2 Oil	.032	25			13.60					.135		.168	
460	613	.055	1.280	None	80-Elec.	.0002	36	1-16	2AM	7.97					.070	.117		
466	749	.128	.650	.234	40-Elec.	.001	14	1-16	2AM	5.90	36	7- 1	12M		.088	.148		
470	96	.008	1.152	.480	50-N. Gas	.003	39	1-16	2AM	7.97	65	7- 1	12M		.041	.069		
*500	1,406	.049	.857	.745	240-N. Gas	.033/.006 NG	246	7- 1	12M	18.10	1044	7- 1	12M		.064		.114	
501	238	.052	.225	.110	85-Elec.	.002	10	1-16	2AM	5.63	22	7- 1	12M		.055		.092	
502	1,308	.155	.292	.128	85-N. Gas	.007	18	7- 1	12M	5.12	231	7- 1	12M		.053		.066	
506	483	.127	.261	None	80-N. Gas	.014	4			3.66					.127		.209	
511	76	.069	.161	None	None	None	3	1-16	2AM	5.31					.153		.257	
512	183	.105	.200	None	50-Elec.	.031	4			8.15					.181		.304	
529	1,334	.110	.960	*	30-N. Gas	.002	18	8-18	3PM	5.23	228	7-20	4PM		.056	.070		
*537	1,408	.054	CP	.481	865-Steam	.010	99	7- 1	12M	8.81	474	7- 1	12M		.023			.023
538	1,190	.055	CP	.601	865-Steam	.010	99	7- 1	12M	8.81	474	7- 1	12M		.023			.023
*600	6,163	.164	CP	1.387	85-N. Gas	.002	193	8-18	4PM	7.98	1511	7- 1	1AM		.039			.041
*601	734	.183	CP	.154	(Served by 600)													
602	467	.129	.330	None	50-N. Gas	.007	16	8-18	4PM	18.45					.325		.406	
604	401	.108	CP	.034	52-Elec.	.001	17	1-16	2AM	11.25	7	7- 1	12M		.102			.103
609	913	.158	.347	.154	52-Elec.	.003	14	1-16	2AM	5.83	34	7- 1	12M		.074		.124	
610	353	.037	CP	.441	15-Elec.	.009	105	7- 1	12M	11.36	588	7- 1	12M		.165			.166
611	738	.076	CP	.349	30-N. Gas	.040	82	7- 1	12M	18.10	565	7- 1	12M		.103			.104
613	3,370	.068	CP	.834	500-Steam	.040	128	7- 1	12M	5.08	167	7- 1	12M		.047			.048

* E-Cube data available for these buildings; all other typical buildings have been estimated based on these computer runs or metered data.

3.1.2 ENERGY CONSUMPTION TABLE FOR EXISTING (TYPICAL) FACILITIES

BLDG. CHARACTERISTICS			HVAC DESIGN		PROCESS LOADS		ELECTRICAL				HEATING AND COOLING LOADS				FUEL CONSUMPTION			
Bldg.#	Window Area (Sq.Ft.)	Window Floor Ratio	Heat Cap. MBTU's	Cool Cap. MBTU's	Dom. Wtr Htr Capacity (Gals.)	Process Systems MBTU/SF	KWatt Demand	Peak Date	Peak Time	Elec Per Yr KWH	Peak Cooling Load KBTU	Peak Date	Peak Time	Cooling Load MBTU'S/ Sq. Ft.	Heating Load MBTU'S/ Sq. Ft.	Nat Gas MBTU'S/ Sq. Ft.	Fuel Oil MBTU'S/ Sq. Ft.	Steam MBTU'S/ Sq. Ft.
614	289	.057	CP	.170	52-Elec.	.002	5	1-16	12M	5.48	25	7- 1	12M		.056			.057
616	278	.129	.140	.036	30-Elec.	.001	5	1-16	12M	6.00	16	7- 1	12M		.061		.102	
*618	1,194	.072	CP	.720	184-Steam	.004	96	7- 1	12M	6.00	720	7- 1	12M		.051			.053
619	167	.136	.082	.060	30-Elec.	.010	7	1-16	2AM	13.20	12	7- 1	12M		.070		.117	
622	412	.137	.240	.021	30-Elec.	.001	7			5.31					.053	.089		
624	132	.066	CP	.067	30-Elec.	.040	11			11.00	14	7- 1	12M		.180			.181
643	896	.077	.299	None	150-N. Gas	.009	10			2.87					.056		.092	
646	589	.088	.424	None	75-N. Gas	.008	4			2.06					.073		.120	
647	966	.089	.299	None	150-N. Gas	.009	7			2.06					.057		.094	
662	2,032	.106	CP	None	300-	.031	43			4.38					.044			
663	1,116	.083	CP	.048	75-N. Gas	.002	29	1-16	2AM	5.31	48	7- 1	12M		.031	.052		
664	889	.108	CP	.054	50-N. Gas	.001	33	1-16	2AM	10.00	43	7- 1	12M		.048			.049
665	652	.080	CP	.060	50-N. Gas	.001	18	1-16	2AM	5.40	37	7- 1	12M		.057			.058
*666	3,005	.092	CP	None	300-N. Gas	.045	73			4.38					.044			
669	636	.057	CP	.241	75-N. Gas	.020	65	7- 1	12M	12.60	434	7- 1	12M		.071			.072
700	83	.038	.225	None	30-Elec.	.009	6			6.80					.087		.108	
900	1,042	.091	.494	None	500-N. Gas	.019	10			2.87					.091		.150	
906	592	.129	.272	None	150-N. Gas	.024	7			5.50					.093		.153	
1002	659	.132	.384	None	150-N. Gas	.053	11			6.10					.171	.282		
1006	844	.133	.512	None	210-N. Gas	.053	11			6.10					.171	.282		
1015	561	.141	.200	None	120-N. Gas	.053	11			6.10					.171	.282		
*1031	899	.146	.640	None	180-N. Gas	.053	11			6.10					.171	.282		

* E-Cube data available for these buildings; all other typical buildings have been estimated based on these computer runs or metered data.
Building 669 - Additional Domestic Water Heater - 75 Gallon Electric

FORT BENJAMIN HARRISON

3.1.2 ENERGY CONSUMPTION TABLE FOR EXISTING (TYPICAL) FACILITIES

BLDG. CHARACTERISTICS			HVAC DESIGN		PROCESS LOADS		ELECTRICAL					HEATING AND COOLING LOADS					FUEL CONSUMPTION		
Bldg.#	Window Area (Sq.Ft.)	Window Floor Ratio	Heat Cap. MBTU's	Cool Cap. MBTU's	Dom. Wtr Htr Capacity (Gals.)	Process Systems MBTU/SF	KWatt Demand	Peak Date	Peak Time	Elec Per Yr KWH	Peak Cooling Load KBTU	Peak Date	Peak Time	Cooling Load MBTU'S/ Sq. Ft.	Heating Load MBTU'S/ Sq. Ft.	Nat Gas MBTU'S/ Sq. Ft.	Fuel Oil MBTU'S/ Sq. Ft.	Steam MBTU'S/ Sq. Ft.
* 1	102,443	.065	41.7	45.8	1600-Steam	.012/.115E	3810	8- 1	2PM	7.04	37335	8- 1	2PM	.01	.026			.026
2			135.8	49.2														
13	780	.044	CP	None	52-Elec.	.002	38	1-16	2AM	5.31					.025			
17	1,095	.092	CP	None	30-N. Gas	.0006	37			7.51					.085			
18	742	.124	CP	.039	None	None	13			5.72	72	7- 1	12M		.097			.098
20	2,061	.051	CP	2.177	318-Steam	.002	284	7- 1	12M	17.00	1365	7- 1	12M		.056			.057
26	1,374	.098	CP	None	52-Elec.	.002	30			5.31					.064			
28	949	.072	CP	.162	30-Elec.	.002	29	1-16	2AM	5.40	53	7- 1	12M		.035			.035
29	190	.058	.212	.141	6-Elec.	.002	18	7- 1	12M	13.57	127	7- 1	12M		.082	.103		
32	217	.013	CP	.227	20-Elec.	.001	35	1-16	2AM	5.00	45	7- 1	12M		.019			.019
33	374	.137	.350	.018	52-Elec.	.001	2	7- 1	12M	2.00	28	7- 1	12M		.168		.211	
35	101	.026	CP	.088	20-Elec.	.001	16	1-16	12M	9.91	15	7- 1	12M		.030			.031
36	3,475	.189	CP	.053	30-Elec.	.0005	43	1-16	12M	5.73	12	7- 1	12M		.081			.082
38	196	.061	.231	None	52-Elec.	.001	20	1-16	12M	15.40					.084	.141		
39	128	.013	.486	.570	60-Elec.	.009	83	7- 1	12M	8.50	516	7- 1	12M		.126	.182		
* 40	71	.005	.396	.338	30-Elec.	.003	101	7- 1	12M	16.00	338	7- 1	12M		.034		.048	
43	262	.121	.123	.050	32-#2 Oil	.003	7	1-16	12M	7.56	8	7- 1	12M		.036		.060	
46	795	.147	.730	None	30-N. Gas	.017	29			13.60					.167	.208		
52	581	.101	.374	.090	85-N. Gas	.007	14	1-16	2AM	4.56	24	7- 1	12M		.065	.081		
54	992	.038	1.152	None	30-Elec.	.0001	56	1-16	12M	5.31					.065		.109	
100	473	.126	.549	.189	10-Elec.	.017	27	7- 1	12M	7.54	521	7- 1	12M		.178		.223	
*101	228	.011	CP	.900	52-Elec.	.006/.035STM	267	7- 1	12M	43.50	900	7- 1	12M		.028			.028
*126	4,953	.074	CP	1.140	300-Steam	.007	183	7- 1	5AM	8.40	1140	7- 1	5AM	.01 STM	.035			.035
127	559	.047	CP	.036	30-Elec.	.002	25			5.31					.122			
237	90	.078	.100	.084	30-Elec.	.031	5	8-18	4PM	18.45	17	8-18	4PM		.701	.876		
*300	2,099	.019	CP	2.000	1666-Steam	.019/.006NG	486	8-18	4PM	18.45	270	8-18	4PM	.041STM	.161			.241
*400	37,551	.115	CP	8.820	626-Elec.	.003	916	8-18	3PM	10.12	8609	7-20	4PM		.045			.050
402	3,251	.081	CP	.720	1311-Steam	.017	118	7- 1	12M	6.95	891	7- 1	12M		.032			.032
404	242	.011	.141	None	30-N. Gas	.024	2			3.60					.112		.185	

* E-Cube data available for these buildings; all other typical buildings have been estimated based on these computer runs or metered data.

3.1.3 FORT BENJAMIN HARRISON ENERGY CONSUMPTION SUMMARY

Parameter	Unit	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80	FY 81
*Area	Sq. Ft.	4,798,000	4,875,000	4,921,000	4,922,000	4,941,000	4,959,000	4,959,000
Source Energy Consumed	MBTU/Yr	1,197,051	1,107,917	1,151,331	1,162,294	1,090,019	1,133,020	1,059,214
*Energy Cost	Dollars/Yr	$ 1,774,902	$ 1,920,150	$ 2,619,811	$ 2,218,101	$ 2,538,868	$ 2,992,254	$ 2,833,588
Source Energy/Area/Year	MBTU/KSF/Yr	249.489	227.265	233.963	236.143	220.607	228.478	213.594
*IRADOC Goal	MBTU/KSF/Yr		222.371	213.105	203.839	194.574	185.309	243.599
Energy Cost/Area/Year	Dollars/KSF/Yr	$ 369.93	$ 393.88	$ 533.37	$ 450.65	$ 513.84	$ 603.40	$ 571.40
Source INdex	Ref. FY 75	100	93	96	97	91	95	88
Cost Index	Ref. FY 75	100	106	148	122	139	163	154
Fuels Consumed	MBTU/Yr	621,900	534,761	568.141	607,756	524,369	540,271	500,314
Fuels Cost	Dollars/Yr	$ 1,119,159	$ 1,050,500	*$ 1,359,812	$ 1,010,759	$ 1,041,642	$ 1,575,368	$ 1,639,338
Fuels Energy/Area/Year	MBTU/KSF/Yr	129.617	109.695	115.452	123.477	106.126	108.948	100.890
Fuels Cost/Area/Year	Dollars/KSF/Yr	$ 233.26	$ 215.49	$ 276.33	$ 205.36	$ 210.82	$ 317.68	$ 330.58
Fuels Index	Ref. FY 75	100	85	91	95	82	84	78
Fuels Cost Index	Ref. FY 75	100	92	133	88	90	136	142
Heating Degree Days	----------	5565	5062	6311	6116	6031	5906	5651
Heating Fuels Index	MBTU/KSF/DD/Yr	.0233	.0217	.0183	.0202	.0176	.0184	.0179
Electricity Consumed	KWH/Yr	49,582,000	49,410,000	50,275,000	47,805,000	48,763,000	51,099,000	48,181,000
Source Electricity Energy	MBTU/Yr	575,151	573,156	583,190	554,538	565,650	592,749	558,900
Electricity Cost	Dollars/Yr	$ 655,743	$ 869,650	$ 1,077,151	1,207,342	$ 1,497,226	$ 1,416,886	$ 1,194,250
Electricity KWH/Area/Year	KWH/SF/Yr	10.334	10.135	10.216	9.713	9.869	10.304	9.716
Electricity Energy/Area/Year	MBTU/KSF/Yr	119.873	117.570	118.510	112.665	114.481	119.530	112.704
Electricity Cost/Area/Year	Dollars/KSF/Yr	$ 136.67	$ 178.39	$ 218.89	$ 245.30	$ 303.02	$ 285.72	240.82
Electricity Index	Ref. FY 75	100	100	101	96	98	103	97
Electricity Cost Index	Ref. FY 75	100	131	162	179	222	209	176
Electrical Demand	Peak KW	**	**	**	9980	10,230	10,200	10,040

* Steam was estimated based upon average unit cost from FY 76 - FY 78
** Information not available

3.2 Future Energy Consumption: This section provides future energy and cost projections for Fort Benjamin Harrison, indicating its trends and future with regard to TRADOC goals for energy consumption reduction.

3.2.1 As a result of the proposed Energy Plan (see Section 2), Fort Benjamin Harrison will experience a significant reduction in energy consumption. As the "Summary of Proposed Savings" chart illustrates, the major reductions will occur in coal and electric consumption. The energy savings (per type) attributable to each energy project are listed in this chart to depict each project's contribution to basewide energy conservation.

3.2.2 As 3.2.1 has illustrated, significant energy savings (MBTU) will result from Increment G and ECIP projects. Yet, the overall reduction in energy consumption does not necessarily translate into reduced energy costs. As 3.2.2 depicts, the rising cost of electricity and fuels will lead to increase $/MBTU for the successive fiscal years and result in higher energy costs for Fort Benjamin Harrison. However, proposed energy consumption reduction will help offset these rising costs.

3.2.1 SUMMARY OF PROPOSED SAVINGS

PROJECT	MBTU SAVINGS ELECTRIC	NAT. GAS	OIL	COAL
Increment G FY82				
Flow Restrictors - Bach Hsg.		1021		3002
Hawley Clinic	4947/1960 KW Demand			10668
Heat Recovery				4249
Flow Restrictors - MFH	20	1737		
Programmable Thermostats		8896		
Hot Water Heater Insulation	4	1210		
Oil Furnace Conversion		-15053	19998	
Oil Boilers - MFH		- 2298	3254	
Central Plant Steam			6795	-5195
Furnaces - MFH		- 242	316	
Central Plant Steam - MFH			4263	-2434
Boiler Conversion - MFH		- 9772	9772	
Subtotal	4971/1960 KW	-14501	44398	10290
ECIP FY85				
EMCS	76461/200 KW	6430	5234	42296
Window Replacement		6205		13556
Building 1	5279/1455.5 KW			117395
Harrison Village		26133		
Building 400				18733
Subtotal	81740/1655.5	38768	5234	191980
TOTAL MBTU	86711/3615.5 KW Demand	24267	49632	202270

3.2.2 PROJECTED ENERGY SAVINGS AND COSTS

		ELECTRIC	NATURAL GAS	OIL	COAL	STEAM	LPG
FY81 Consumption							
	MBTUs	558,900	102,219	67,712	318,400	10,677	1,306
	FY81 $	$1,194,250	$367,468	$599,213	$ 915,329	$44,306	$ 7,118
FY82 Incr. G Savings							
	MBTU	4,971	-14,501	44,398	10,290	———	———
	(KW)	1,960					
FY82 Consumption							
	MBTU	553,929	116,720	23,314	308,110	10,677	1,306
	$/MBTU	x $1.27	x $2.84	x $9.88	x $3.80	x $4.67	x $6.20
		x $4.71/KW					
FY82 Costs		$1,243,818	$ 331,485	$230,342	$1,170,818	$49,862	$ 8,097
FY85 (ECIP) Savings							
	MBTUs	81,740	38,768	5,234	191,980	———	———
	(KW)	1665.5					
FY85 Consumption							
	MBTU	472,189	77,952	18,080	116,130	10,677	1,306
	$/MBTU	x $1.83	x $4.21	x$14.63	x $5.06	x $5.99	x $9.18
		x $6.80/KW					
FY85 Costs		$1,515,896	$ 328,178	$264,510	$ 587,618	$63,955	$11,989

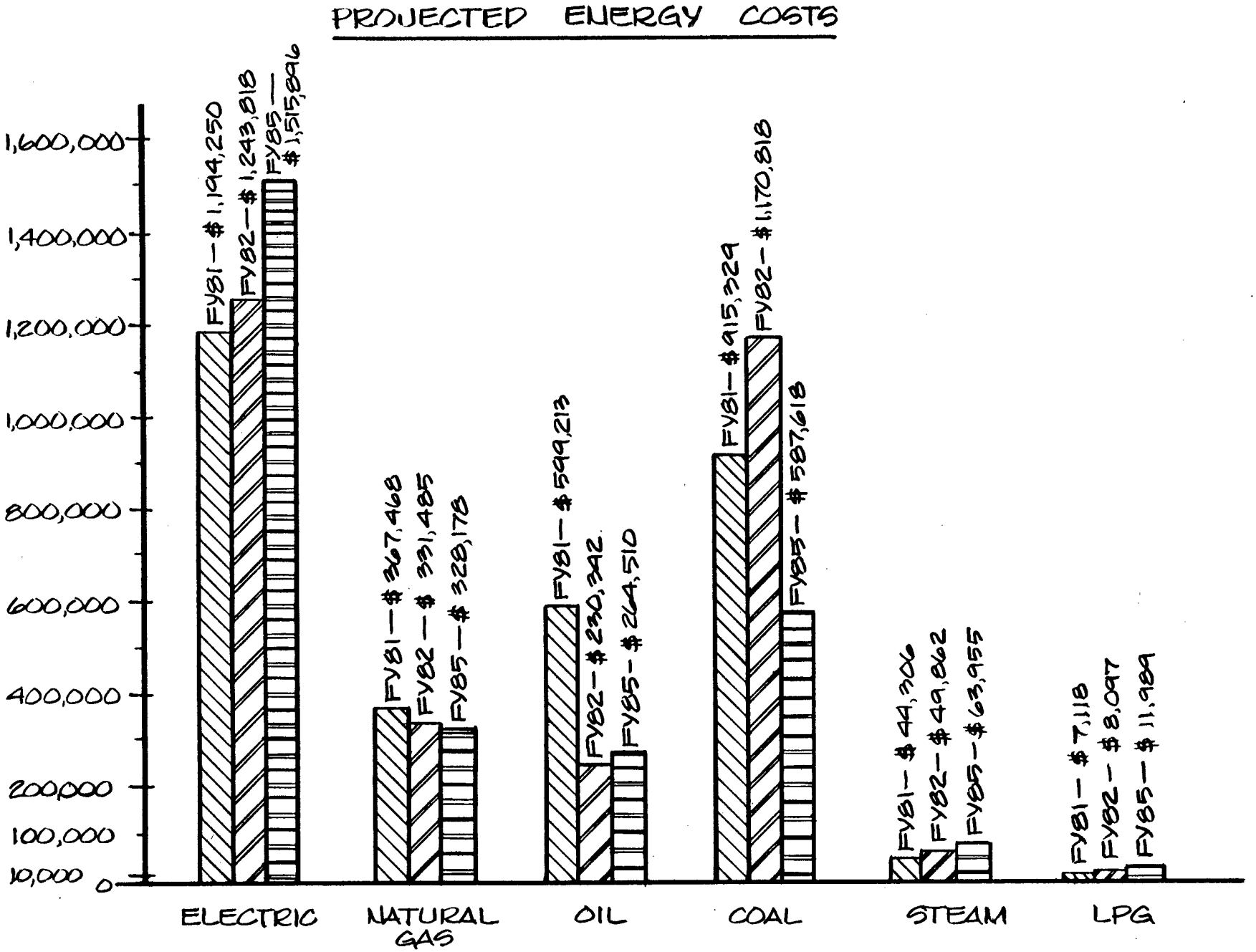

PROJECTED ENERGY COSTS
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
100,000
10,000
0
FY81 — $1,194,250
FY82 — $1,243,818
FY85 — $1,515,896
FY81 — $367,468
FY82 — $ 331,485
FY85 — $ 328,178
FY81 — $599,213
FY82 — $230,342
FY85 — $264,510
FY81 — $915,329
FY82 — $1,170,818
FY85 — $587,618
FY81 — $44,306
FY82 — $49,862
FY85 — $63,955
FY81 — $7,118
FY82 — $8,047
FY85 — $11,984
ELECTRIC
NATURAL GAS
OIL
COAL
STEAM
LPG

FIG. 3.2.2-A

3.2.3 and 3.2.4 These charts and their corresponding graphs provide Fort Benjamin Harrison's historical basewide consumption and predict future consumption in relationship to TRADOC goals. Future consumption is graphed according to predicted energy savings through the implementation of proposed Increment G and ECIP projects. As 3.2.3-A and 3.2.4-A illustrate, Fort Benjamin Harrison will exceed their TRADOC goals through these proposed energy projects.

3.2.3 FBH HISTORICAL ENERGY CONSUMPTION AND FUTURE GOALS

(MBTU/YR AND ADJUSTED FOR DEGREE DAY)

	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85
MBTU/YR	1,197,051	1,107,917	1,151,331	1,162,294	1,090,019	1,133,020	1,059,214	1,122,235	1,047,420	972,604	897,788
D.D./YR	6602	5842	7672	7421	6890	7101	6635	6551	6551	6551	6551
MBTU/D.D./YR	181.32	189.65	150.07	156.62	158.20	159.58	159.64	171.31	159.89	148.47	137.05

3.2.4 FBH HISTORICAL ENERGY CONSUMPTION AND FUTURE GOALS

(MBTU/YR AND BTU/SQ.FT./DEGREE DAY)

	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85
MBTU/YR	1,197,051	1,107,917	1,151,331	1,162,294	1,090,019	1,133,020	1,059,214				
SQ. FT.	4,798,000	4,875,000	4,921,000	4,922,000	4,941,000	4,959,000	4,959,000				
MBTU/SQ.FT.	.2495	.2273	.2339	.2361	.2206	.2285	.2136	.2370	.2246	.2121	.1996
D.D./YR	6602	5842	7672	7421	6890	7101	6635	6551	6551	6551	6551
BTU/SQ.FT./D.D.	37.79	38.91	30.49	31.82	32.02	32.18	32.19	36.18	34.28	32.37	30.47

Energy goals are based on reductions of 25% (MBTU/YR.) and 20% (MBTU/SQ.FT.), utilizing FY 75 data.

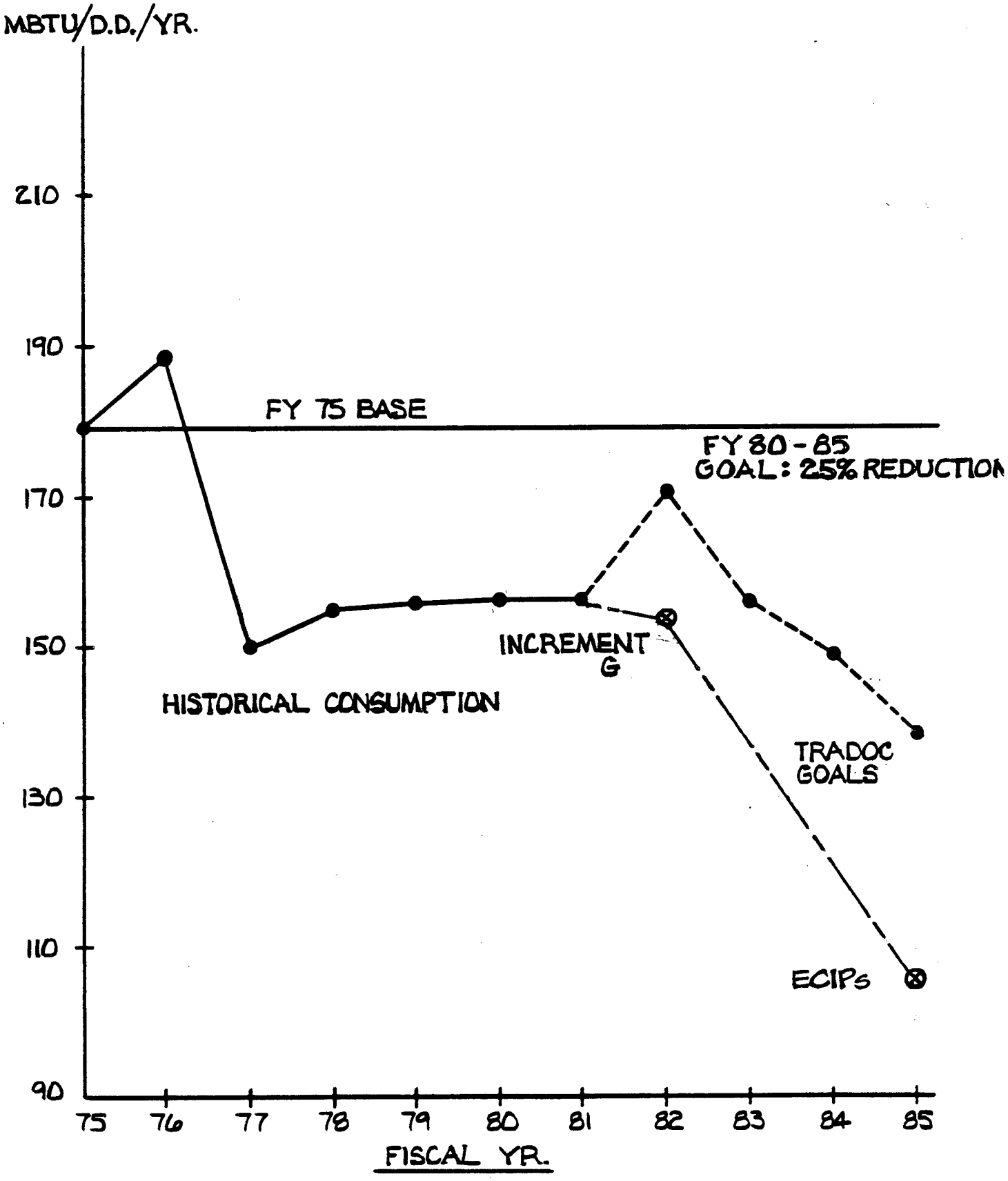


FIGURE 32.3-A
FBH HISTORICAL ENERGY CONSUMPTION
AND FUTURE GOALS

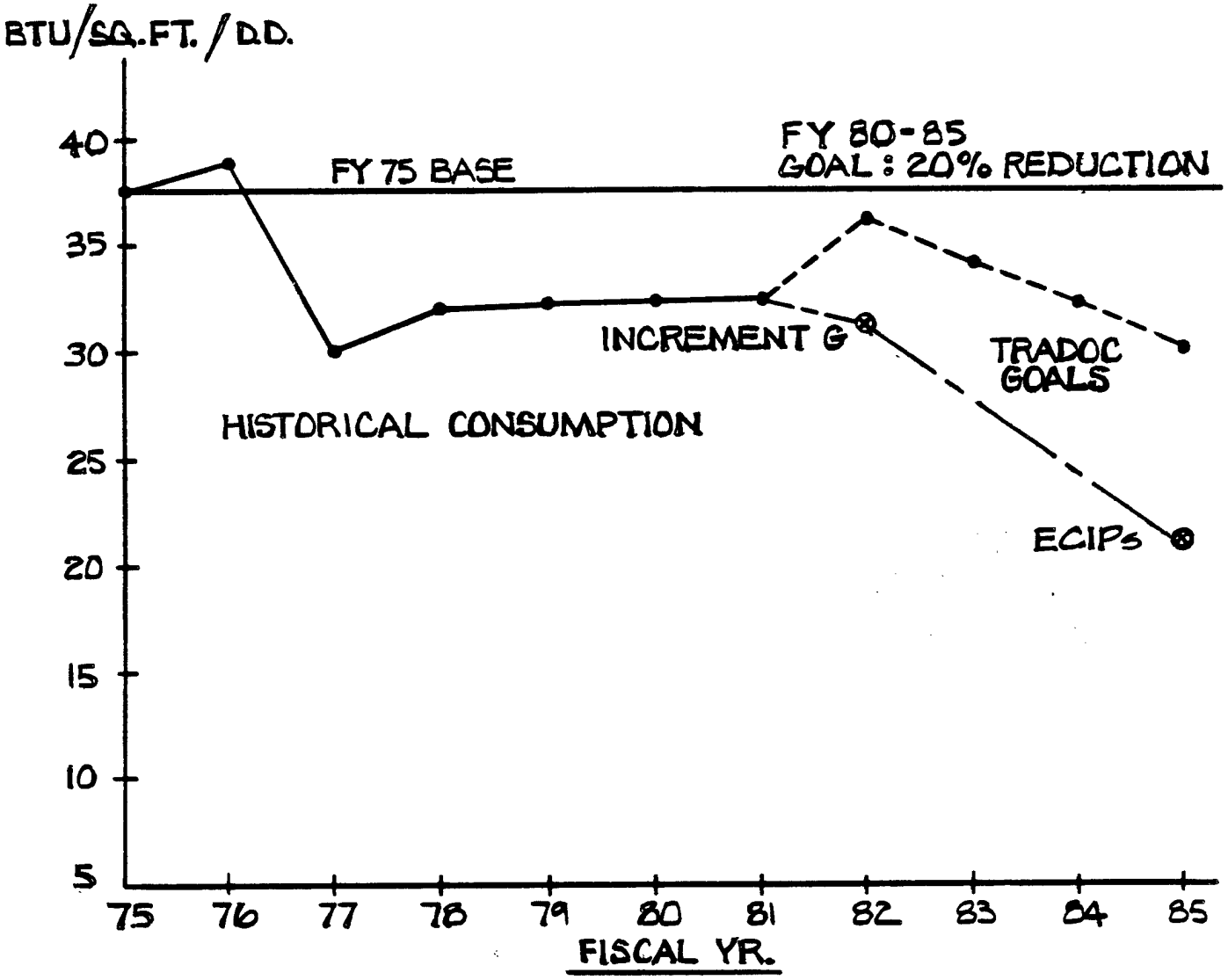


FIGURE 3.2.4-A
FBH HISTORICAL ENERGY CONSUMPTION
AND FUTURE GOALS